9506M

MRI 3103-1

Omega 1400

Service Manual

Omega 1400 series

Non-Invasive Blood Pressure Monitors

Invivo
Research
Incorporated

Precision Biomedical Instruments

Invivo Research Incorporated • 12601 Research Parkway • Orlando, Florida 32826

Invivo Oscillometric Monitor

Model 1400 MRI

Service Manual

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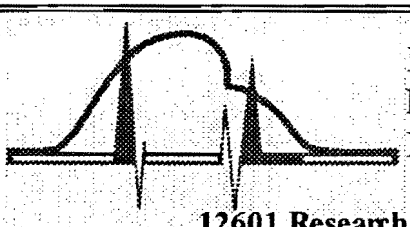

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SPECIFICATIONS

PNEUMATICS SYSTEM

Cuff Inflation Time	3 to 20 seconds
Cuff Deflation Time	20 to 50 seconds typical; 180 seconds maximum
Transducer Drift	±3 torr per year
Transducer Repeatability	±1 torr
Leak Rate (Maximum)	Less than 20 torr per minute at 200 torr
Overpressure Valve	Opens at 270 ±14 torr

ACCURACY

Pulse Rate	2% full scale
Pressure Zero Offset	6 torr ±5 torr
Pressure Span Accuracy	±2 torr
Pressure Range	0 to 255 torr (Adult/Pediatric) 0 to 210 torr (Neonate)

OPERATIONAL ENVIRONMENT

Operating Temperature Range	10 to 44°C (50 to 110°F)
Storage Temperature Range	-18 to 52°C (0 to 125°F)
Humidity	10 to 90% relative, non-condensing
Altitude Range	-1000 to 10,000 feet

PHYSICAL DIMENSIONS

Height	4.25 inches (10.8 cm)
Width	9.45 inches (24 cm)
Depth	10 inches (25.4 cm)
Weight	6 lbs, 15 oz (3.15 kg)

ACCESSORIES FOR THE 3103 OMEGA 1400 MRI

DESCRIPTION	PRODUCT CODE
Omegacart, MRI	9002M
Handbulb Assembly	9001
Twin-Lumen Adult Air Hose, MRI	9010M
Single-Lumen Neonatal Air Hose, MRI	9010NM
Operations Manual	9505M
Service Manual	9506M

REUSABLE BLOOD PRESSURE CUFFS

Adult Cuff, MRI	9070M
Adult Cuff, Large Arm, MRI	9080M
Pediatric Cuff, MRI	9060M
Adult Cuff, Thigh, MRI	9090M

DISPOSABLE NEONATAL BLOOD PRESSURE CUFFS

A complete selection of disposable neonatal blood pressure cuffs is available with either hook-and-loop or tape c[illegible]ures. Cuffs are of soft, white vinyl. Each cuff is individually packaged in its own peel pouch, and is ready for use. Gas sterilizable. Luer fittings.

FOR SPECIFICATIONS AND PRICING OF ALL OMEGA 1400 ACCESSORIES, CONTACT INVIVO CUSTOMER SERVICES **TOLL FREE: 800-331-3220.**

PRECAUTIONS

The Omega 1400 (Model 3101-1) is especially modified for MRI use and has been constructed with minimal ferrous material. However, small amounts of magnetically attractable materials have remained (i.e.: screws and pump motor), and this unit must be kept at least five feet from the bore. It is recommended that the unit be strapped or restrained to some permanent structure, or mounted on an Invivo MRI (Aluminum) cart and kept greater than five feet from magnet bore. **NEVER PLACE THIS DEVICE ON THE PATIENT TABLE OR INTO THE BORE.**

When using this instrument to monitor blood pressure, remember that the patient's blood pressure readings are not continuous, but are updated each time a blood pressure measurement is taken. Set the INTERVAL from the Omni-Trak's NIBP menu to shorter time periods for more frequent updating of the patient's blood pressure.

Monitor is not intended for use in the presence of flammable anesthetics. An explosion hazard exists.

Do not attach the cuff to a limb being used for infusion. Cuff inflation can block infusion, possibly causing harm to the patient.

Never immerse the unit in any fluid or attempt to clean it with liquid cleaning agents. An electrical hazard exists.

Do not use a monitor that has failed in any part of the calibration or leak tests. The values displayed by such a unit are inaccurate.

No repair should be undertaken or attempted by anyone not having a thorough understanding of the repair of automatic blood pressure monitors.

USER RESPONSIBILITY

This product will perform in conformity with the description thereof contained in this service manual and accompanying labels and/or inserts, when assembled, operated, maintained and repaired in accordance with the instructions provided. This product must be checked and calibrated periodically. A defective product should not be used. Parts that are broken, missing, plainly worn, distorted or contaminated should be replaced immediately. Should such repair or replacement become necessary, Invivo Research, Incorporated (IRI) recommends that a telephone call (toll free: (800) 331 - 3220) or written request for service be made to the nearest factory service center. This product or any of its parts should not be repaired other than in accordance with written instructions provided by IRI, or altered without written approval of IRI. The user of the product shall have the sole responsibility for any malfunction which results from improper use, faulty maintenance, improper repair, damage or alteration by anyone other than Invivo Research or Invivo Research authorized service personnel.

SECTION I

OPERATION OF THE MONITOR

This section provides a brief overview of Oscillometric Monitors, provides information on the controls and indicators of the monitor and provides instructions on the operation of the monitor.

1. OPERATION OF THE MONITOR

1.1 Introduction

By deriving it's power from the MRI monitoring system, or from the HE28A AC adapter, the 3101 Omega 1400 MRI can function as a stand alone device. When in System configuration, the monitor may be started or stopped either by it's front panel controls or from the Omni-Trak's NIBP menu controls. Users in the magnet room and control room should coordinate their control of the Omega 1400 when in System configuration.

1.1.1 Brief Theory of Operation. The Omega 1400 series monitors make blood pressure measurements based on the Oscillometric principle. Oscillometric Monitors use an inflatable occlusive cuff which is also used in the manual auscultatory technique; however, rather than monitoring undependable Korotkoff sounds, Oscillometric Monitors detect and measure oscillations induced in the cuff by the movement of the arterial wall.

Steps a through d describe the process of Oscillometric Measurement:

a. As the occlusive cuff is inflated to a suprasystolic pressure the artery is occluded so that no blood passes through.

b. As cuff pressure is reduced to just below the systolic pressure, the force of the height of the systolic pressure wave forces the occluded artery open, blood spurts through the artery and the amplitude of the oscillations increase sharply. This is known as systolic pressure.

c. With further reduction in cuff pressure: the artery opens for a longer time during each cardiac cycle, which causes increasingly larger oscillations in the cuff pressure until they reach a point of maximum oscillation amplitude. This point of maximum oscillations has been well-demonstrated to be Mean Arterial Pressure (see Geddes, L.A., et al, "*The Meaning of the Point of Maximum Oscillations in Cuff Pressure in the Indirect Measurement of Blood Pressure*").

d. With continued cuff-pressure reduction, the underlying artery is open throughout the cardiac cycle, and the arterial-wall movement is less. The cuff pressure oscillations begin to decrease in amplitude until they become uniform. The point at which the amplitudes become uniform is diastolic pressure.

1.1.2 Simplified Theory of Operation. In simple terms, oscillometric monitors utilize a pressure transducer which is connected to the cuff via a hose. The transducer transforms the oscillations induced into the cuff pressure into electrical currents. Under control of a microprocessor and software algorithms, the electrical current can then be measured and correlated with the cuff pressure to determine arterial blood pressure.

1.2 Description of Omega 1400 Series Monitors

The Omega 1400 Series Adult/Neonate Monitors are non-invasive blood pressure monitors which automatically measure and display a patient's systolic, diastolic and mean arterial blood pressures at preset intervals. They may also display information upon operator demand. Besides blood pressure information, the average pulse rate is also determined and displayed on the front panel with the blood pressure values.

1.2.1 ADULT/NEONATE Selector. The ADULT/NEONATE selector allows the monitor to determine pressures on a wide range of patients. Several operational parameters (including cuff inflation pressure) are varied depending on the setting of the ADULT/NEONATE selector which allows the appropriate operation for each patient selected.

1.2.2 Adult/Neonate Safeguards. Two automatic safeguards prevent inadvertent switching of the ADULT/NEONATE selector, and improper mode and cuff size matching. First, changing the setting of the ADULT/NEONATE selector while power is ON will cause the monitor to lock up and will sound the ALARM. Second, the monitor senses the size of the cuff being used and will ALARM if a neonatal cuff is used in the Adult mode, or if an adult cuff is used in the Neonatal mode.

1.2.3 International Standard Labeling. Omega 1400 monitors are labeled with "torr", the international standard of pressure measurement, for blood pressure values. One torr equals one mmHg (millimeter of mercury).

1.2.4 Alarm Limits. Alarm limits for SYSTOLIC, DIASTOLIC and MEAN arterial pressures as well as pulse rate are set to predetermined values upon initial power up. The Alarm limits may be changed or disabled by the operator at any time by use of the Alarms SELECT, Alarms ON/OFF, HI SET and LO SET controls. An audible alarm tone and visual signal are triggered whenever a blood pressure parameter alarm limit is violated.

1.2.5 Alarm Violation Routine. Once violated, the Alarm sounds for 16 seconds, after which another blood pressure measurement is taken. If the Alarm limits are violated during the new reading, the Alarm tone sounds for another 16 seconds. The monitor will alternate between pressure reading cycles and Alarms until the violated parameter returns within limits, the HOLD control is pressed or the Alarms are inactivated with the Alarms ON/OFF control.

1.2.6 Blood Pressure Reading Intervals. A blood pressure reading may be taken at automatic intervals, or the operator can take manual control of the monitor's determination cycles at any time using the START or HOLD controls. If the Digital Manometer mode is selected, the cuff can be inflated with an optional hand bulb, and blood pressure measurements made with the auscultatory technique.

WARNING

The patient's blood pressure determinations are updated each time a blood pressure measurement is taken and are not continuous. When using this instrument to monitor critical conditions set the INTERVAL display to shorter periods for more frequent updating of the blood pressure determinations.

1.2.7 Normal Operation. During normal operation, the displayed blood pressures and pulse rate indicate the patient's condition at the time of the last measurement. Depending on the setting in the INTERVAL display, as long as 99 minutes may elapse between blood pressure measurement cycles; during this time, the patient's condition may change. Correspondingly, the alarms reflect only the patient's condition during the last blood pressure measurement, and not changes that may occur between measurements.

1.3 Controls and Indicators

Reference Figures 1-1 and 1-2 for Control and Indicator locations.

1.3.1 Front Panel. **(See Figure 1-1)** There are five displays, seven indicator lights and six soft touch controls located on the front panel. The following is a brief discription of every control and indicator located on the front panel:

NOTE

Omega monitors use the international unit of pressure measurement, "torr." One torr equals one mmHg (millimeter of mercury).

1.3.1.1 SYSTOLIC torr Display. **Item 1**. The SYSTOLIC torr display provides a visual indication of the last systolic blood pressure of the patient.

1.3.1.2 MEAN torr Display. **Item 2**. The MEAN torr display performs three functions:

a. The MEAN torr display indicates the last measured arterial pressure of the patient.

b. During a blood pressure determination cycle, the MEAN torr display indicates the actual cuff pressure.

c. While in the Digital Manometer mode, the MEAN torr display indicates the actual cuff pressure.

1.3.1.3 HOLD Indicator. **Item 3**. The HOLD indicator provides a visual indication that the monitor is in the Hold mode.

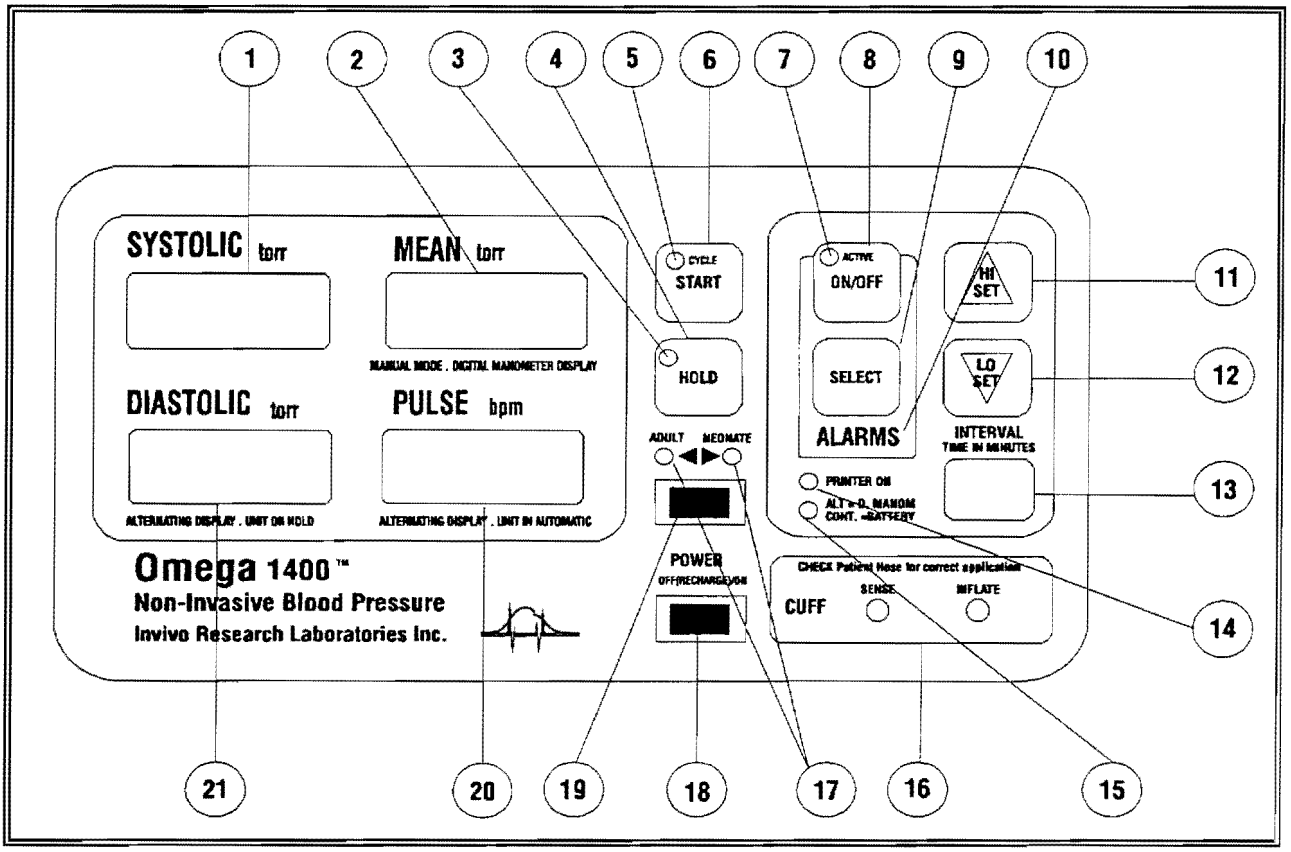

Figure 1-1. Omega 1400MRI Front Panel

1.3.1.4 HOLD Control. **Item 4**. The HOLD Control performs two functions:

a. Depressing and holding the HOLD control until one short tone sounds places monitor in the Hold mode. The HOLD indicator will illuminate, and the time in Hold will be alternately displayed in DIASTOLIC display. HOLD cancels a determination in progress, and also silences an alarm condition.

b. Depressing and holding the HOLD control until two short tones sound (approximately three seconds) places the monitor in the Digital Manometer mode. The DIGITAL MANOMETER MODE indicator will illuminate.

1.3.1.5 CYCLE Indicator. **Item 5**. The CYCLE indicator provides a visual indication that the monitor is performing a blood pressure determination cycle.

1.3.1.6 START Control. **Item 6**. The Start control is used to initiate a blood pressure determination cycle. A blood pressure determination cycle is initiated by depressing the START control until one tone sounds and the CYCLE indicator illuminates.

1.3.1.7 Alarms ACTIVE Indicator. **Item 7**. The Alarms ACTIVE indicator provides a visual operation the one (or all) of the blood pressure parameter Alarms are active.

NOTE

If connected to the System, alarms and intervals are controlled by the Omni-Trak in the control room via the Alarms menu, NIBP section.

1.3.1.8 Alarms ON/OFF Control. **Item 8**. The Alarms ON/OFF control is used for the following:

a. Turn all alarms OFF or ON at one time.

b. To turn off the Alarms for a particular parameter (while in the Select mode).

c. To silence the Alarm.

1.3.1.9 Alarms SELECT Control. **Item 9**. The Alarms SELECT control is used to put the monitor in the Select mode. The following settings may be made from the Select mode:

a. The blood pressure parameter may be viewed and/or adjusted.

b. The blood pressure Alarms may be turned ON or OFF.

Depressing the Alarms SELECT control will display each blood pressure parameter display on the front panel in a counterclockwise fashion. The first depression displays MEAN, the second displays SYSTOLIC, the third display DIASTOLIC and the fourth display PULSE. The selected display will alternate between the High Alarm limit and the Low Alarm limit.

As a safety feature, if no controls are pressed within approximately ten seconds, the monitor will exit the Select mode.

1.3.1.10 ALARMS Indicator. **Item 10**. The ALARMS indicator provides a visual indication that the Alarm limit has been violated.

1.3.1.11 HI SET Control. **Item 11**. The HI SET control performs three functions:

a. While in the Alarms Select mode: momentarily depressing the HI SET control will cause the High Alarm limit for the selected parameter to "freeze" in the display for approximately one second.

b. While in the Alarms Select mode: depressing and holding the HI SET control will increase the High Alarm limit of the selected parameter by increments of five torr. Once the upper limit of the High Alarm is reached, the display will "roll over" to the lower limit and continue to increase in five torr increments.

c. In all other modes: depressing the HI SET control will increment the Interval. Pressing once and releasing will increment the time by one minute while pressing and holding will cause the time to increment by ten minute intervals.

1.3.1.12 LO SET Control. **Item 12**. The LO SET control performs three functions:

a. While in the Alarms Select mode: momentarily depressing the LO SET control will cause the Low Alarm limit for the selected parameter to "freeze" in the display for approximately one second.

b. While in the Alarms Select mode: depressing and holding the LO SET control will increase the Low Alarm limit of the selected parameter by increments of five torr. Once the upper limit of the Low Alarm is reached, the display will "roll over" to the higher limit and continue to increase in five torr increments.

c. In all other modes: depressing the LO SET control will decrement the Interval. Pressing once and releasing will decrement the time by one minute while pressing and holding will cause the time to decrement by ten minute intervals.

1.3.1.13 INTERVAL Display. **Item 13**. The INTERVAL display is not active on the Omega 1400MRI. Intervals are controlled by Omni-Trak.

1.3.1.14 PRINTER ON Indicator. **Item 14**. The PRINTER ON indicator is not active on the Omega 1400MRI. The 1400MRI is not equipped with an internal printer.

1.3.1.15 DIGITAL MANOMETER MODE Indicator. **Item 15**. The DIGITAL MANOMETER MODE indicator performs two functions:

a. If flashing, the DIGITAL MANOMETER MODE indicator provides a visual indication that the monitor is in the Digital Manometer Mode.

b. If steadily illuminated, the DIGITAL MANOMETER MODE indicator provides a visual indication that the monitor is on internal battery operation (if so equipped).

1.3.1.16 CUFF Ports. **Item 16**. The two CUFF ports provide for the connection of the external air hose (a twin-lumen for adult use, or single-lumen for neonate use). Either connection on the hose may be used on either port. Screw air hose connections snugly into place for an air tight fit.

1.3.1.17 ADULT/NEONATE Indicators. **Item 17**. The ADULT/NEONATE indicators provide a visual indication of the setting of the ADULT/NEONATE selector.

1.3.1.18 POWER Switch. **Item 18**. The POWER switch is a two position switch. To turn the monitor ON, depress the right side; to turn the monitor OFF, depress the left side. When power is applied: all LED indicators will illuminate, a brief tone will sound, the INTERVAL display will indicate "88" and the SYSTOLIC, DIASTOLIC, MEAN and PULSE displays will indicate "188" then "288."

1.3.1.19 ADULT/NEONATE Selector. **Item 19**. The ADULT/NEONATE selector is a two position switch which allows the operator to select the operation appropriate to the patient. This selector controls the following:

a. The initial cuff inflation pressure of the pump.

b. The preset Alarm limits.

c. The maximum and minimum high and low Alarm limit ranges.

d. The software algorithm for adult or neonate operation.

As a safety feature, the monitor will lock up and the Alarm will sound if this setting is changed while the unit is ON. If this occurs, reset the monitor for proper operation by turning the monitor OFF, placing the ADULT/NEONATE selector in the desired position and turning the monitor ON.

1.3.1.20 PULSE bpm Display. **Item 20**. The PULSE bpm display performs two functions:

a. The PULSE bpm display indicates the average measured pulse rate of the patient (in beats per minute) during the last blood pressure determination cycle.

b. In the Automatic Interval mode, the PULSE bpm display alternately indicates elapsed time since the last blood pressure determination cycle.

1.3.1.21 DIASTOLIC torr Display. **Item 21**. The DIASTOLIC torr display performs two functions:

a. The DIASTOLIC torr display indicates the last measured diastolic blood pressure of the patient.

b. When the monitor is in the Hold mode, the DIASTOLIC torr display will alternate between the last measured diastolic blood pressure of the patient and the elapsed time in the Hold mode.

1.3.2 Back Panel. **(See Figure 1-2)** The back panel consists of a digital manometer connection, one paper feed control, one I/O port, Cautions/Warnings, the Alarm Volume control and the Alarm Tone control. The following is a discription of the controls and notes located on the back panel:

1.3.2.1 DIGITAL MANOMETER Port. **Item 1**. The DIGITAL MANOMETER Port is a screw connector which provides for use of a hand bulb when the Omega 1400 is in the Digital Manometer mode.

1.3.2.2 PAPER FEED Control. **Item 2.** This control is not used.

1.3.2.3 I/O Port. **Item 3**. The I/O Port provides for the connection of Omni-Trak MRI System Power and serial communication interface.

1.3.2.4 CAUTIONS/WARNINGS. **Item 4.** Text which alerts the operator to potential hazards. **Invivo strongly recommends that every operator become throughly familier with these Cautions and Warnings, as well as the Cautions and Warning section in the front of this manual, before operating the 1400 MRI Non-Invasive Blood Pressure Monitor.**

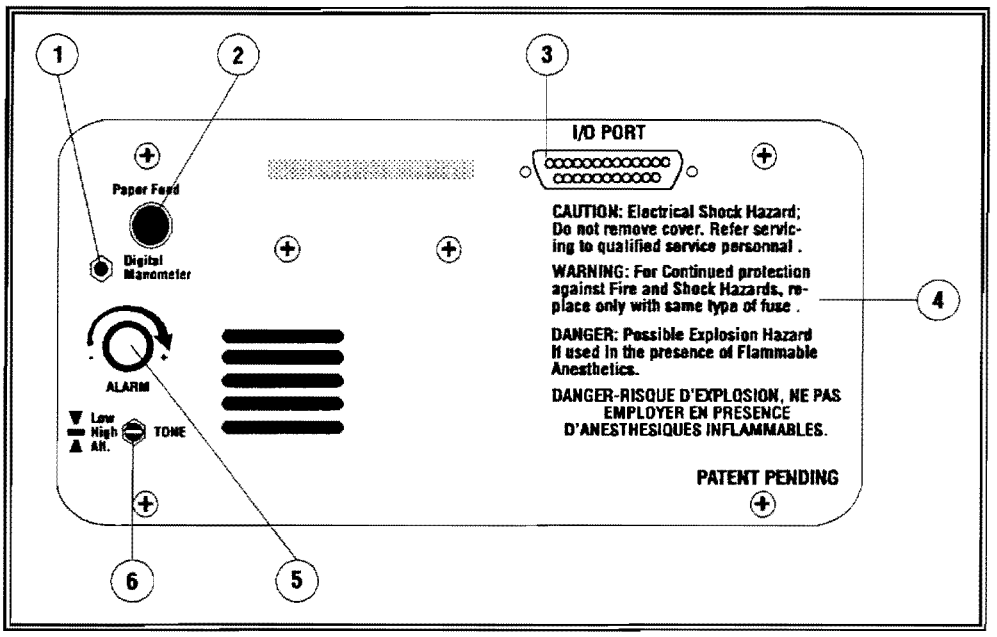

Figure 1-2. Omega 1400MRI Back Panel

1.3.2.5 ALARM TONE Control. **Item 5**. The ALARM TONE Control is a three position toggle switch which permits the operator to select the following Alarm tones:

a. Low pitch (Top position).

b. High pitch (Center position).

c. Alternating pitch (Bottom position).

NOTE

To avoid confusion: it is recommended that the operator select the alarm tone which will allow alarms on this monitor to be distinguished from alarms on other monitoring equipment.

1.3.2.6 ALARM Volume Control. **Item 6**. The ALARM Volume Control allows the operator to control the volume (amplitude) of the audible alarm tone.

NOTE

As a safety feature, the alarm volume may be lowered, but cannot be completely turned off.

1.4 Operation of the Monitor

WARNING

Never use this monitor in the presence of flammable anesthetics: AN EXPLOSION HAZARD EXISTS.

1.4.1 Cuff Preparation. The patient should remain calm and motionless while the monitor is being used. If the patient is overactive, more time is required to take an accurate reading.

1.4.1.1 Cuff Selection. The cuff is selected and positioned as it would be for an auscultatory blood pressure determination, and the guidelines of the American Heart Association in their publication *Recommendations for Human Blood Pressure Determination by Sphygmomanometers* should be followed. The bladder width of the cuff should be 40% of the circumference of the limb. For a correct fit on adult and pediatric non-disposable cuffs, the Index line on the end of the cuff must fall between the two Range lines printed on the inside of the cuff. For correct fit on neonatal disposable cuffs, choose the size whose stated circumference range fits the circumference of the limb of the neonate.

WARNING

Do not attach the cuff to a limb being used for infusion. Cuff inflation can block the infusion causing possible harm to patient.

1.4.1.2 Cuff Positioning. The cuff should be wrapped firmly (not snug) around the arm of the patient and positioned as close to heart level as possible. If the cuff is not at heart level, add 1.8 torr to the displayed readings for each inch that the center of the cuff is located above the patient's heart level; subtract 1.8 torr from the displayed readings for each inch that the cuff is located below the patient's heart level.

1.4.1.3 Cuff Connection. Select the proper hose (twin-lumen for adults, single-lumen for neonates), and attach hose to cuff. Route the hose from the cuff to the monitor so it does not kink, tangle, or limit access to the patient.

NOTE

As a safety feature, if the setting of the ADULT/NEONATE selector is changed while the monitor's power is ON, the monitor will lock up and the alarm will sound. Therefore, prior to turning power ON, switch the ADULT/NEONATE selector to the proper setting for the patient and the cuff selected.

1.4.2 Monitor Operation. Operation of the monitor is as follows:

1.4.2.1 Power Up Routine. Pressing the POWER switch to the right to turn the monitor ON. Upon power up the monitor performs a routine which allows the operator to verify correct functioning of the Alarm, displays and indicators. The power up routine is as follows:

a. ADULT indicator illuminates.

b. ADULT indicator goes out, NEONATE and PRINTER ON indicators illuminate.

c. The four blood pressure displays indicate "188" for approximately two seconds, then indicate "288", two Alarm Tones sound while ALARMS indicator flashes, and all indicators (except NEONATE) are illuminated.

d. All indicators (except ADULT) go out.

e. ADULT or NEONATE (as selected) and ACTIVE indicators are illuminated.

f. HOLD, ACTIVE and ADULT or NEONATE (as selected) indicators are illuminated.

g. After approximately three seconds: four touch tones sound which indicates that control has been transferred to the Omni-Trak.

h. HOLD and ADULT or NEONATE (as selected) indicators are illuminated.

1.4.2.2 Operator Override. The operator may override automatic operation of the monitor at any time by use of the START or HOLD controls.

1.4.2.3 Operator Initiation of Blood Pressure Determination Cycle. The operator may initiate a blood pressure determination cycle by depressing the START control. At the completion of the blood pressure determination cycle, the monitor will enter the Hold mode and return control to the Omni-Trak.

1.4.3 Automatic Interval. See "Omni-BUS" section of the Omni-Trak Operator manual. Select Auto/Interval or Manual mode from the NIBP menu of the Omni-Trak.

1.4.4 Alarms. On initial power-up, the alarms on all four blood pressure parameters (systolic, diastolic and mean arterial pressures, and pulse rate) are automatically turned off by the Omni-Trak.

(See Omni-BUS) section of the Omni-Trak operations manual) The limits are set on the Omni-Trak Alarms chart display menu. This monitor does have "stand alone" capability; while operating as a stand alone monitor, control of the Alarm Parameters is accomplished as described in paragraphs 1.4.4.1 through 1.4.4.7.

1.4.4.1 Preset Alarm Limits at the Omega 1400. Should alarm monitoring be desired at the Omega 1400, press the Alarms ON/OFF control on the front panel. The ACTIVE indicator will illuminate and Alarms on all four blood pressure parameters (systolic, diastolic and mean arterial pressures, and pulse rate) are turned ON. The High and Low Alarm limit pre-sets are listed in **Table 1-1.**

1.4.4.2 Turning Alarms OFF On Individual Parameters. To turn off the alarms on individual parameters, perform the following:

a. Select the parameter to be turned OFF by depressing the Alarms SELECT control until the desired parameter is selected. The selected display will alternate between the High and Low Alarm limits.

NOTE

As a safety feature, if no controls are pressed for approximately ten seconds while in the Select mode, the monitor will exit automatically.

b. Depress the Alarms ON/OFF control until a short tone sounds.

c. Release the Alarms ON/OFF control.

d. The display will begin to alternate between "00" and "255" indicating that the alarm for that parameter is OFF.

NOTE

The Alarms ACTIVE indicator will remain illuminated as long as **any one** alarm is active.

1.4.4.3 Range of High and Low Alarm Limits. The High and Low Alarm limits for each blood pressure parameter can be set within a range. The ranges are listed in **Table 1-2.**

Table 1-1: High and Low Alarm Pre-Set Limits

ADULT MODE	HIGH LIMIT	LOW LIMIT
Systolic	190 torr	65 torr
Diastolic	125 torr	40 torr
Mean	135 torr	55 torr
Pulse	160 bpm	45 bpm
NEONATE MODE		
Systolic	130 torr	40 torr
Diastolic	80 torr	25 torr
Mean	100 torr	30 torr
Pulse	210 bpm	60 bpm

Table 1-2: High and Low Alarm Limit Ranges

ADULT MODE	HIGH RANGE	LOW RANGE
Systolic	80 to 235 torr	60 to 135 torr
Diastolic	30 to 175 torr	30 to 95 torr
Mean	75 to 195 torr	40 to 120 torr
Pulse	50 to 195 bpm	40 to 95 bpm
NEONATE MODE		
Systolic	65 to 175 torr	35 to 95 torr
Diastolic	40 to 115 torr	15 to 80 torr
Mean	50 to 145 torr	15 to 85 torr
Pulse	100 to 215 bpm	55 to 115 bpm

1.4.4.4 Checking Alarm Limits. To check the Alarm limits, perform the following:

a. Select the parameter to be checked by depressing the Alarms SELECT control until the desired parameter is selected. The selected display will alternate between the High and Low Alarm limits.

b. Depress and release the HI SET control (this will cause the **High** Alarm limit to "freeze" in the display for approximately one second).

c. Depress and release the LO SET control (this will cause the **Low** Alarm limit to "freeze" in the display for approximately one second).

1.4.4.5 Changing Alarm Limits. To change the Alarm limits, perform the following:

a. Select the parameter to be changed by depressing the Alarms SELECT control until the desired parameter is selected. The selected display will alternate between the High and Low Alarm limits.

b. To change the **High** Alarm limit, depress the HI SET control and the limit will increase in five torr increments. When the Alarm limit reaches the highest range, the display will "roll over" to the lowest range and continue to increase by five torr increments.

c. To change the **Low** Alarm limit, depress the LO SET control and the limit will increase in five torr increments. When the Alarm limit reaches the highest range, the display will "roll over" to the lowest range and continue to increase by five torr increments.

1.4.4.6 Alarm Violations. When an alarm limit is violated, the alarm tone sounds for 16 seconds, the red ALARMS indicator flashes, and the display(s) of the violated alarm(s) flash on and off. After 16 seconds, the monitor begins a new pressure determination cycle. The unit continues to cycle between alarms and pressure measurements as long as alarm limits are violated.

To silence an alarm: Place the monitor in Hold, or **briefly** depress the Alarms ON/OFF control; four short tones will sound, each blood pressure parameter display will flash briefly, and the Alarms ACTIVE indicator will extinguish.

1.4.4.7 Other Factors That Can Trigger An Alarm. In addition to violating an **active** alarm limit on a blood pressure parameter, there are other factors which will cause the monitor to alarm. The Omega 1400 has the following built-in safety features which will cause the monitor to alarm, regardless of the settings of the alarm limits or the Alarms ON/OFF control:

a. A pressure reading takes more than 2.5 minutes.

b. The cuff inflation pump runs longer than 22 seconds in the Adult mode, or longer than six seconds in the Neonate mode.

c. Cuff pressure remains at one level for more than 30 seconds during a determination cycle.

d. A hardware (electronic or electrical) malfunction stops the microprocessor for three minutes.

e. A MAP of less than ten torr.

f. A pulse rate of "0".

CAUTION

When in the Digital Manometer mode, the operator is in control of the cuff pressure. When finished, completely exhaust the cuff pressure, then **close** the hand bulb bleed valve.

1.4.5 Digital Manometer Mode. If the patient shows signs of arrhythmia, the automatic circuitry within the monitor may have difficulty determining blood pressures and pulse rates. This is usually evidenced by long blood pressure determination cycles, or by an alarm caused by pressure readings which take longer than three minutes. In such instances, or whenever desired, the operator may configure the monitor for manual (auscultatory) blood pressure measurements. this may be done without changing the cuff or front-panel how connections.

To configure the monitor for manual blood pressure measurements, perform the following:

a. Remove the red protective cover from the DIGITAL MANOMETER port on the back panel of the monitor.

b. Connect the accessory hand bulb by screwing the hand bulb hose connector firmly for an air tight fit.

CAUTION

When the hand bulb is not connected, the protective red cover should be replaced on the port to keep out dust and dirt.

c. Depress and hold the HOLD control until two short tones sound. The DIGITAL MANOMETER indicator will begin to flash, indicating that the monitor is in the Digital Manometer mode.

d. The MEAN display is now a digital manometer, and will read actual cuff pressure. The operator now has 60 seconds to perform manual measurements. Pressurize the cuff with the hand bulb and use auscultatory techniques to determine blood pressure values.

After 60 seconds have elapsed, the monitor automatically exits from the Digital Manometer mode, enters the Hold mode and sounds one tone to signal the transition. At this time, the last automatically determined MAP is returned to the MEAN display.

The operator may then enter the Digital Manometer mode with the HOLD control, or press START to resume automatic monitoring.

SECTION II

THEORY OF OPERATION

This section describes the operation of Invivo Research Omega 1400 Series Non-Invasive Blood Pressure Monitors.

2 THEORY OF OPERATION

2.1 Introduction to the Theory of Oscillometric Blood Pressure Measurement

Oscillometry is the technique is utilized by the Omega 1400 monitor. It is the most widely-used method of automated non-invasive blood pressure monitoring.

2.1.1 Discovery. Dr. Etienne Marey, French physiologist and inventor, invented the sphygmograph in 1860. In 1976, after extensive research using the sphygmograph, Dr. Marey discovered the principle of using oscillations induced in cuff pressure by the arterial blood pressure wave. Subsequent modern-day research has correlated oscillometric blood pressure measurements with other accepted means (i.e. invasive arterial techniques).

2.1.2 Technique. Oscillometric Monitors use an inflatable occlusive cuff which is also used in the manual auscultatory technique; however, rather than monitoring undependable Korotkoff sounds, Oscillometric Monitors detect and measure oscillations induced in the cuff by the movement of the arterial wall.

Steps a through e describe the Blood Pressure Reading Cycle used by Oscillometric Monitors to perform detection and measurement of the oscillations induced in the cuff by the movement of the arterial wall:

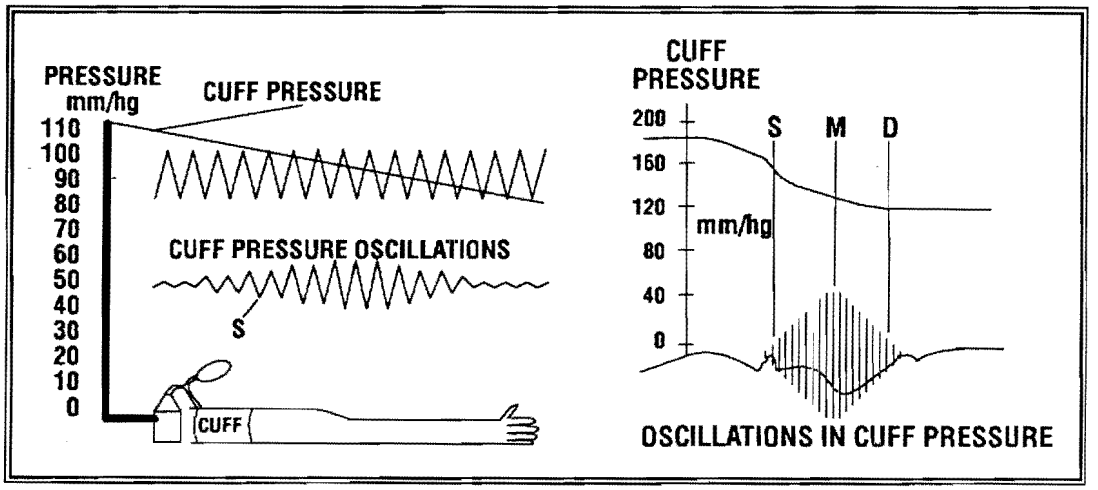

Figure 2-1: Oscillometric Measurement Technique

DEFINITION: The monitor defines systolic pressure as the pressure in the cuff when the magnitude of the oscillations induced into the cuff change from a steady state to a constantly-increasing magnitude.

a. As the cuff is inflated to a suprasystolic pressure (using the same technique as a manual sphygmomanometer) the artery is occluded so that no blood passes through. At this point, even though no blood flows under the cuff, there are small pulsations induced into the cuff pressure by the partially-occluded proximal portion of the artery lying under the cuff (see **Figure 2-1**).

b. As cuff pressure is reduced, less counter-pressure is applied to the underlying artery, and the length of the occluded segment of the artery is decreased. At this point, the oscillations in cuff pressure begin to increase slightly.

c. As cuff pressure continues to be reduced to just below the systolic pressure, the force of the systolic pressure wave forces the occluded portion of the artery open, blood spurts through the artery, and the amplitudes of the oscillations increase sharply.

d. With further reduction in cuff pressure: the artery opens for a longer time during each cardiac cycle, the arterial wall oscillates with a larger amplitude, and cuff oscillations increase markedly in amplitude until they reach a maximum point. This point of maximum oscillations has been well-demonstrated to be Mean Arterial Pressure (MAP).

NOTE

MAP and the point of maximum oscillations are equal until the ratio of *air volume in the cuff* to the *volume of the artery under compression* exceeds 10 to 1. Therefore, **cuff air volume should be keep to a minimum by using the smallest cuff size possible for each patient.**

e. With continued cuff-pressure reduction, the underlying artery is open throughout the cardiac cycle; the arterial-wall movement is less, and the amplitude of the cuff-pressure oscillations decrease and then become uniform in amplitude. The point at which the oscillations become uniform is diastolic pressure.

The OMEGA 1400 also determines the pulse rate by measuring the time between peaks of the cuff-pressure oscillations and then extrapolating the average number of beats per minute. This average is taken over the entire Blood Pressure Reading Cycle.

2.1.3 The Importance of Correct Cuff Size. The size of the bladder contained in the blood pressure cuff is important to prevent erroneous readings. The recommendations of the American Heart Association, which are contained in their publication *Recommendations for Human Blood Pressure Determination by Sphygmomanometers*, and other references in the Suggested Reading List at the end of this Section, should be adhered to.

The American Heart Association makes the following recommendations:

a. "The bladder must be the correct width for the diameter of the patient's arm, for if it is too narrow, the blood pressure reading will be erroneously high; if it is to wide, the reading may be erroneously low. The width of the inflatable bladder should be 40% of the circumference of the mid point of the limb (or 20% wider than the diameter) on which it is to be used...."

b. "The length of the inflatable bladder also influences the accuracy of the measurement. The length of the bladder should be twice the recommended width (bladder length equal to 80% of arm circumference)...."

A variety of cuff sizes (both reusable and disposable) for the Omega 1400 are available from Invivo Research.

2.2 Logical Sequence Theory

2.2.1 Introduction. The following is an overview of the logical sequence the OMEGA 1400 microprocessor follows during normal operation. It serves as a written flowchart of the monitor's software.

2.2.2 Initial Power-Up. The following is a brief description of the Initial Power-Up sequence:

NOTE

If any of the following checks perceive a failure, the monitor will hang up.

a. Performs set up and clears the memory of any previous data in preparation for collection and storage of oscillatory data.

b. Performs short RAM check.

c. Reads user commands from front-panel switches.

   (1) Checks Alarms and Hi/Lo Set.
   (2) Checks Start.
   (3) Checks Hold.

d. Transducer check and EPROM check.

   (1) Opens transducer to air.
   (2) Checks that transducer can be auto-zeroed, and that data is within safety range.
   (3) Checks ROM data checksum.

e. Begins initial reading within 10 seconds if all checks pass.

2.2.3 Reading Cycle. The following is a brief description of the reading cycle.

NOTE

If failures are perceived during the following checks, the monitor will hang up.

a. Re-zeros the transducer and checks EPROM data.

b. Closes the valves and begins inflation of cuff.

c. Inflates cuff pressure to the calculated level.

Initial default = 170 mmHg for Adult Mode
110 mmHg for Neonate Mode

DEFINITION: Oscillations are signals of magnitude ≥ to the default amplitude, which happen at least twice during each pressure step and are similar in shape.

d. Inspects cuff pressure for the presence of oscillations.

e. Steps the cuff pressure downward.

f. Continues searching for and storage of oscillation data.

g. Begins to count number of artifact events. The step sizes range from 14 to 3 torr (mmHg), depending on internal software calculations.

h. Stops the oscillation search.

i. Vents the pressure five oscillation-amplitude steps after the maximum.

j. The microprocessor searches through the oscillatory data in the memory buffer (RAM) for the point of maximum oscillations. Tangent lines are constructed from the point of maximum oscillations to the minimums on either side of this point. The cuff pressure at the point of maximum oscillations is the value for mean arterial pressure. If the data are "clean" (i.e., artifact count is low, and/or signal amplitude is large), the value for MAP is displayed on the front panel.

NOTE

The systolic and diastolic pressures are the points at which the above-mentioned tangent lines intersect the pressure axis. These points are adjusted, as may be appropriate, due to artifact count and/or signal quality. The systolic and diastolic values are then displayed on the front panel.

k. The microprocessor finds the heart rate by calculating the average time between all detected-and-stored oscillations. It checks for high time variability and displays the heart rate.

If the monitor was unable to obtain systolic pressure, but a non-alarm MAP was obtained, there is a 20-second delay and another reading cycle is initiated. This is not repeated if no systolic pressure is obtained after the second attempt.

NOTE

The following describes manual operation of the Interval Delay Modes. In normal operation, the Intervals are controlled by the Omni-Trak. If operator takes manual control **the Interval limits between the Omni-Trak and the monitor will not be the same.**

2.2.4 Interval Delay Modes. The following is a brief description of the two interval delay modes:

a. **AUTOMATIC INTERVAL:** The Automatic Interval mode is entered upon successful completion of a reading cycle (i.e., no alarm condition or manual intervention).

(1) The Interval delay setting is read, and the time is counted in minutes plus one.

(2) The time since the previous reading cycle has ended is alternately displayed in the Pulse display.

(3) User commands from front-panel controls are checked (e.g., Alarms-settings changes, manual Start, Hold, Digital Manometer).

(4) A reading cycle is initiated when the set time has expired.

(5) The Automatic Interval mode is again entered upon successful completion of the reading cycle.

b. **HOLD MODE:** The Hold mode is entered by pressing the HOLD control; the monitor will signal with one tone and illuminate the Hold indicator.

(1) The time since Hold was initiated is alternately displayed in the DIASTOLIC display.

(2) User commands from front-panel controls are checked, as in the Automatic Interval mode.

2.2.5 Digital Manometer Mode. The following is a brief description of the digital manometer mode:

The Digital Manometer mode is implemented by pressing and holding the HOLD control on the front panel until two touch tones sound.

a. The cuff pressure is vented (by opening the dump valve) and allowed to stabilize within the safety range.

b. The transducer is auto-zeroed.

c. The dump valve is closed and the "ALT = D. MANOM." indicator blinks.

d. The cuff pressure is measured by the transducer and displayed in the MEAN display.

e. After 60 seconds have elapsed, the monitor automatically exits this mode and opens the dump valve. It then enters the Hold mode, signals the transition with one tone, illuminates the Hold indicator, and begins displaying time in Hold alternately in the DIASTOLIC display.

f. The last automatically-determined MAP is returned to the MEAN display.

2.3 Functional Description

REFERENCE DIAGRAM 97D149 (APPENDIX A, PAGE A-2)

2.3.1 System Overview. The Omega 1400 is a microprocessor-based system. Overall operation (except for overpressure and failsafe timer) is controlled by the microprocessor (a Z-80) and its software.

System Timing: System timing is coordinated by the system clock (crystal controlled at 4 MHz) which supplies the timing for the microprocessor (2 MHz), interrupt generator (1 MHz), and analog to digital converter (1 MHz).

System Reset: The system reset is an active reset circuit which holds the system reset during power-up, and also activates on power-down or power interruptions.

Memory Select: Memory select logic, along with microprocessor *RD and *WR lines, select EPROM memory for software instructions and RAM memory for collected-data storage or recall. Along with this select logic the address bus calls for a unique location to respond. Then, the data bus provides an 8-bit-wide channel to these responses.

Input Buffer: The input buffer presents data from the real-time clock to the data bus at the appropriate time specified by the select logic for interpretation by the microprocessor front-panel switches.

Output Latches: Data for output latches is strobed into the output latch buffer by the microprocessor *WR line; then the appropriate output latch is selected to latch the buffered data.

2.3.2 Normal Operation. During normal operation, the pump, valve and alarm logic is under microprocessor control. Should the microprocessor malfunction and fail to send a reset to the failsafe timer logic within three minutes, the failsafe timer will activate, generate an alarm and disable the pump and valve.

2.3.3 Information Display. To display information, the microprocessor first selects the display to be updated by using three display latch output decode lines, resets the display, and then sends a stream of display clock pulses equal to the number to be displayed.

2.3.4 Analog to Digital Converter. The analog to digital converter (ADC) is a single CMOS integrated circuit. The ADC receives a channel-select command via the microprocessor data bus and I/O select line to the ADC's address latch enable (ALE). This command sets the ADC's eight-channel analog multiplexer to one of six active input channels:

a. AC line-voltage monitor
b. +5 V supply-voltage monitor
c. Adult AC offset
d. DC offset
e. Neonatal AC offset

2.4 AB08A Processor Board

REFERENCE DRAWING 55D067 (APPENDIX A, PAGE A-6)

2.4.1 System Clock. The overall system timing (excluding failsafe) is controlled by a basic 4 MHz clock, consisting of X1 and two gates of U5. This clock signal is divided into 2 MHz and 1 MHz by U4. The 2 MHz output (U4, pin 8) is shaped by active pullup Q1 for the microprocessor. The 1 MHz output (U4, pin 5) drives the interrupt timer (U12) and the A/D converter (U25).

2.4.2 System Reset. An active reset, made up of Q9, Q10, Q11, and two gates of U5, holds system reset during power-up (approximately 350 msec) until the system clock and supply voltages stabilize. This reset also activates on power- down or power interruptions, when the +5 V supply drops below 4.2 V.

2.4.3 System Interrupt. The interrupt pulse is derived from the 4 MHz system clock, and is utilized by the microprocessor for all time-keeping functions. The 1 MHz output of U4 is fed through ripple counter U12 and its associated 4 diodes, generating a 200 usec interrupt pulse every 8.4 msec.

2.4.4 Microprocessor and Memory. The microprocessor, a Z-80 type in location U11, utilizes its control functions (*RD, *WT, *I0RQ, and *MEMR) in conjunction with its address lines to access the program stored in U15 (2764 EPROM). From this stored program, it performs the software routines for reading the front-panel control switches, input from the A/D converter, control for the pneumatics, displaying information, self-checking the RAM and EPROM memories, and all other processing functions.

2.4.5 RAM Memory. Two 2114s (U21 and U26) combined, form 1 KByte of RAM memory on A[illegible]08A boards revision S and below or one 6116 2 KByte SRAM on AB08A boards revision T and ab[illegible]e, are used as scratchpad memory for the microprocessor. Software controlled timers (via in[illegible]errupt), pressure and oscillation data, alarm limits, and various other variables collected and modified by the microprocessor, are stored in RAM.

2.4.6 Memory Select. Memory select is accomplished using upper address lines (A13, A14, and A15) and memory request line (*MEMR) to drive the memory select device U6 (a 74HC138). The memory select logic enables the proper memory device (RAM or EPROM) to be read. The processor write line (*WR), in addition to this memory select logic, is used to write to RAM.

2.4.7 Failsafe Timer. In case of microprocessor malfunction: a special backup safety timer circuit is designed to sound the alarm, disable the pump and open the valve to depressurize the cuff.

2.4.7.1 Normal Operation. During normal operation, the microprocessor resets this timer circuit. Timer U17 oscillates at approximately 45 Hz to provide a time base to counter U16. Counter U16 divides the pulse rate from timer U17 by 8192 to cause output-pin 3 to toggle every three minutes, ±30 seconds. During normal operation the counter is kept reset via U13 (pin 8).

Counter output U16 (pin 3) is inverted by a gate of U14. This inverted output (active low) is connected to NAND gate U13, where it enables alarm output. The alarm output signal for Q2 disables the valve, and via CR5, disables the pump.

A higher-frequency signal at pin 7 of U16 provides the alarm blink signal, which causes the alternating tone (if activated on the rear panel board) and the alarm bar indicator to blink on the display board.

2.4.8 Real-Time Clock. The real-time clock, U27 (a 3835 with software revision OM4D and below or a DS1202 with software revision OM4E and above), provides seconds, minutes, hours, date, month, and year data to the microprocessor upon request via I/O line pin 6. Its clock input, pin 2 (32.7 kHz), is provided by inverter U29 and crystal X2. Power for this circuit is supplied via CR18 (unit power, when on), or CR21 (battery, when unit power is off). R96 is an 82K resistor when U27 is a 3835 or a 33K when U27 is a DS1202.

2.4.9 Analog to Digital (A/D) Converter. This function is performed by a single CMOS IC, U25. The A/D receives a channel-select command via the microprocessor data bus and the address enable

(AE) line. This command sets the A/D's eight-channel analog multiplexer to one of the six analog inputs. A start of convert (ST) signal will cause the A/D to convert the analog voltage present on the selected channel into eight bits of digital resolution. The A/D will then place the 8-bit value on the microprocessor data bus when output enable (OE) is received.

U25, pin 1 (I3), monitors the line signal to determine if the unit is operating from internal battery or AC line power. U25, pin 2 (I4), monitors the unit's +5 V. supply voltage. U25, pin 3 (I5), monitors the unit's internal battery for low battery warning. U25, pin 26, monitors Adult AC (blood-pressure oscillation) for the Adult mode. U25, pin 27, monitors DC offset (cuff pressure).

U25, pin 28, monitors Neonate AC (cuff-pressure oscillation) for the Neonate mode.

The A/D analog inputs are connected through resistor divider networks to reduce input signals to readable A/D levels. Also, for A/D protection, diode clamping networks are connected to each input.

2.4.10 Analog Section. The analog circuits consist of a voltage reference, AC and DC pressure amplifiers, and their associated filters and AGC.

A +10 V reference is supplied by a 723 regulator, U18, operating from the unit's +12 V supply. This +10 V reference is coupled through one half of U20 for use by the A/D diode clamp network. It is also divided by R27 and R28, then coupled through the other half of U20 to supply +5 V reference for transducer excitation and A/D.

Output of U23, pin 1, provides the DC gain signal for the A/D, with offset adjusted by R34 and gain adjusted by R33. The AC component of this signal is fed to U23, pin 5. This half of U23, and the first half of U19, form a 2.5 Hz band-pass filter for blood-pressure oscillations. The output of U19, pin 1, is fed to both the adult and neonate AC amplifiers. The adult amplifier has a gain of 2, and the neonatal amplifier has a gain of 8. See the Calibration section of this manual for adjustment.

2.5 AB08C Display Board

REFERENCE DRAWING 85D060 (APPENDIX A, PAGE A-12)

The Omega 1400 presents information on four three-digit displays, and one two-digit display. This *information is transmitted from the Processor board to the Display board via P1, using three decode lines (A0, A1 and A2), a reset line and a clock line.

Information is transmitted to any display through demultiplexers U10 and U11, selected by the decoder lines. The display is first reset by a signal gated through U10 to the three-digit BCD counter/latch, (U2, U4, U6, U8 or U14, depending on which display is selected). Then, clock pulses, equaling the number to be displayed, are gated through U11 to the selected three-digit counter and latched in through BCD latches.

The counter then sequentially outputs each digit (units, tens, hundreds) to the BCD to seven-segment drives (U1, U3, U5, U7, or U14) along with corresponding transistor-driver enabling lines (DS1,

DS2, or DS3), turning on one digit at a time. Leading-zero blanking is accomplished by using the "F" segment to disable the driver transistor for the hundreds digit.

Outputs from U10 and U11 are also used to set/reset flip-flops U12, driving the indicators for ADULT or NEONATE. All other indicators are driven directly from the Processor board.

The Display board also interconnects the front-panel switches to the Processor board, signal "tone" from the Processor board to the Rear Panel Control board, and signal "alarm blink" from the Rear Panel Control board to the Alarm bar indicator.

2.6 AB08D Rear Panel Control Board

REFERENCE DRAWING 85C064 (APPENDIX A, PAGE A-10)

The Rear Panel Control board provides control for and generation of alarm tone, as well as interconnect to the Display board, valve and pump drive circuit.

U1 is designed as a free-running oscillator, with its frequency altered from High, Low, or Alternating tones, by Q6 and S2. U1's output is connected to volume control R25, and is turned on and off by Q2, which is driven by the processor alarm signal.

The speaker amplifier (U1, Q3, Q4, and Q5) is driven by the touch-tone generated by the Processor board through touch-tone volume control R18, or alarm oscillator U1 through alarm volume control R25.

Signal alarm blink (J1, pin 2) is connected to Switch 2 for alternating alarm tone, and through CR1 to the Display board for Alarm bar indicator blinking.

2.7 AP21 Pump-Drive Assembly

REFERENCE DRAWING 85B070 (APPENDIX A, PAGE A-16)

The pump-drive assembly (mounted directly on the pump) provides control of the pneumatic system pressurization when commanded by the pump signal from the Rear Panel Control board. J2 receives regulated +12 VDC, and the pump-control signal from the Rear Panel Control board.

Unregulated DC from the Power Supply board is received at J1 to power the pump.

When a pump-signal command is received, the pump signal input goes high (12 VDC), turning on FET Q1, and switching the regulated +12 VDC through a voltage divider, consisting of R1 and R2 (voltage drop across the FET is negligible). This applies a signal of approximately +9 VDC to the base of Darlington switch Q2, and results in the application of a controlled voltage of +8.5 to 9.0 VDC to the pump motor. Pump "soft start" is provided by Q3 and R3 by current limiting the pump to approximately 1 amp.

The pump pressurizes the pneumatic system until commanded by the system to stop. When the pump signal is low (0 VDC), FET Q1 is turned off, voltage at the base of Q2 is zero (Q2 is turned off), and no voltage is applied to the pump motor.

NOTE

Pump-drive signal voltages are non-critical, and may vary as much as 20 percent without affecting the operation of the system.

2.8 Power Circuitry

REFERENCE DRAWING 85C127 (APPENDIX A, PAGE A-8)

The Omega 1400MRI receives power from the Omni-Trak unit through the serial port on the rear panel.

2.9 AB08F2 Power Supply Board

REFERENCE DRAWING 85C127 (APPENDIX A, PAGE A-8)

The Power Supply is a dedicated, switching, three-voltage output supply, designed to make high-efficiency use of the power provided by the Omni-Trak. This is accomplished by a single-ferrite transformer which provides the three DC voltages (+5, +12, and -8) required by the system.

The +5 volt supply is regulated by the switcher duty cycle, and the +12 volt and -8 volt supplies are regulated by conventional linear means.

2.10 AB20A Protocol Converter Board

REFERENCE DRAWING 85D113 (APPENDIX A, PAGE A-14)

The Protocol Converter Board provides control communications to the Omega 1400 NIBP for the Omni-Trak 3100 MRI. When communication is active between this board and the Omni-Trak, the Omni-Trak takes control of the Omega 1400. Under this control, the Omega 1400 alarms and interval controls are disabled and controlled through Omni-Buss communications. If there is no communication between the Omni-Trak and the Protocol converter, the Omega 1400 will operate under it's own Alarm and Interval controls.

2.10.1 Connection. The Protocol Converter board connects to the Omega 1400's AB08A Processor board via it's dual 26 pin connector J2. This connection provides power and communication between the monitor and the Omni-Trak.

2.10.2 Reset. An active reset, made up of Q1, Q2, and Q3, holds system reset during power-up (approx. 350 ms) until the system clock and supply voltages stabilize. This reset also activates on power down or power interruptions, when the +5 V supply drops below 4.2 V.

2.10.3 Microprocessor and Memory. The microprocessor, a Z-80 type in location U1, utilizes its control functions (*RD, *WT, *IOE and *ME) in conjunction with its address lines to access the program stored in U2 (27256 EPROM). From this stored program, it performs the software routines for communication via it's two TX and RX channels self checking the RAM and EPROM memories, and all other processing functions.

2.10.4 Memory Select. Memory select is accomplished using upper address lines (A13, A14, and A15) and memory request line (*ME) to drive the memory select device U5 (a 74HC00). The memory select logic enables the proper memory device (RAM or EPROM) to be read. The processor write line (*WR), in addition to this memory select logic, is used to write to RAM.

2.10.5 Omega 1400 COMM. The processor's RXA1 line (pin 49) receives information from the Omega 1400 via it's PR SERIAL and HOLD LED lines through gate U6, and the processors TXA1 line (pin 48) transmits information to the Omega 1400 through a gate and latch network made up of U4 and U6.

2.10.6 MRI Omni-Trak 3100 COMM. The processor's RXA0 (pin 46), TXA0 (pin 45), *CTS0 (pin 43), and *RTS0 (pin 42) provides communication to Omni-Trak 3100 through RS232 Driver/Receiver U7.

SUGGESTED READING LIST

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SECTION III

CALIBRATION MODES

This section describes the three calibration modes which provide for a "cover-on" calibration check of the OMEGA 1400 Series Monitors.

NOTE

For further information on the Calibration modes, refer to Section IV: Calibration and Verification.

3. CALIBRATION MODES

3.1 Test-Calibration Mode 1

Test-Calibration Mode 1 does not require that the OMEGA 1400 Monitor's cover be removed, and does not require any external test equipment. Test-Calibration Mode 1 checks the following:

- DC Offset
- Adult AC Offset
- Neonatal AC Offset

NOTE

DC Offset, Adult AC Offset and Neonatal AC Offset are key voltages and **MUST BE CHECKED A MINIMUM OF EVERY SIX MONTHS**. Except where noted, the hoses should not be connected to either the Sense or Inflate ports on the front of the monitor, or the Manometer port on the rear of the monitor during these calibration procedures.

3.1.1 Initiation of Test-Calibration Mode 1. To enter Test-Calibration Mode 1:

a. Turn POWER switch to the OFF position.

b. Depress and hold the START control while turning the POWER switch to the ON position.

NOTE

The monitor will remain in Test-Calibration Mode 1 for approximately 3.5 minutes. After this time, the monitor's failsafe timer will open the valve, and the alarm will sound.

c. When the ALARM TONE sounds, release the START control.

d. Observe the following indications:

(1) ALARM indicator is flashing.

(2) MAIN display indicates "188" then "288."

(3) INTERVAL display indicates "88."

(4) All INDICATORS (except NEONATE) are on.

(5) SYSTOLIC display indicates the DC Offset of the internal pressure transducer. This must read between 3 and 9 torr.

(6) DIASTOLIC display indicates the Adult AC Offset of the pressure transducer. This must read 80 ±5.

(7) PULSE display indicates the Neonatal AC Offset. This must read 80 ±5.

The AC Offsets may also be used to detect excessively-noisy pressure transducers. This is done by checking the AC Offsets for fluctuations from their normal values of 80 ±5. If the readings rapidly fluctuate by more than two units on the Adult AC Offset (in the Diastolic display), or by more than four units on the Neonatal AC Offset (in the Pulse display), it is advisable to confirm the status of the transducer by means of an oscilloscope (see Section IV).

3.1.2 Manual Leak Test. An automatic leak test is performed in Test-Calibration Mode 3 (See Paragraph 3.3). If desired a manual leak test may be performed as follows:

a. While in Test-Calibration Mode 1, connect a standard mercury manometer and handbulb with a "T" fitting to the Sense Port on the monitor. The pressure will be shown in the MEAN display.

b. Apply 200 torr with the handbulb. The pressure shown in the MEAN display should read ±3 torr of the manometer's reading. If not, see Section IV, for adjustment procedure.

c. Observe the pressure reading for one minute. If the pressure drops 20 torr per minute or more, the pneumatic system is faulty.

3.1.3 Test-Calibration Mode 1 Exit. To exit Test-Calibration Mode 1, turn the POWER switch to the OFF position.

3.2 Test-Calibration Mode 2

Test-Calibration Mode 2 performs an automatic RAM check.

3.2.1 Initiation of Test-Calibration Mode 2. Test-Calibration Mode 2 may be entered by two methods:

a. From Test-Calibration Mode 1:

(1) Depress and hold the START control.

(2) When ALARM TONE sounds five times, release the START control.

(3) The monitor will enter Test-Calibration Mode 2.

b. From Power Off:

(1) Depress and hold the START control, and turn POWER switch to the ON position.

(2) When ALARM TONE sounds five times, release the START control.

(3) The monitor will enter Test-Calibration Mode 2.

3.2.2 RAM Test. The RAM test automatically begins with "00" in both the SYSTOLIC and DIASTOLIC displays. The SYSTOLIC display is now a "pass" counter for the RAM test, and will increment by one for each error-free pass. If a RAM test failure occurs, the unit will alarm, and the pass counter will stop. After 3 1/2 minutes in this mode, the unit will automatically alarm (failsafe), but the pass counter will continue.

3.2.3 Test-Calibration Mode 2 Exit. To exit Test-Calibration Mode 2, turn the POWER switch to the OFF position.

3.3 Test-Calibration Mode 3

Test-Calibration Mode 3 performs an automatic leak test on the pneumatics system of the monitor.

3.3.1 Initiation of Test-Calibration Mode 3. To enter Test-Calibration Mode 3:

a. Close the pneumatic circuit by connecting the patient hose and cuff to the SE INFLATE ports, and wrapping the cuff tightly around a 3" tube or other suitable hard surface.

b. Turn the POWER switch to the OFF position.

c. Depress and hold the HOLD control while turning the POWER switch to the ON position.

d. The monitor will begin the automatic leak test. The test will repeat until interrupted.

3.3.2 Automatic Leak Test. The monitor will inflate approximately 200 torr and begin a 30-second leak test. If the beginning and ending pressures differ by 10 torr or more, this test will be counted as a failure. The SYSTOLIC display will show the number of leak tests completed and the DIASTOLIC display will show the number of leak failures. The Mean display will show the beginning pressure and the PULSE display will show the current pressure during the leak test.

3.3.2.1 Valve and Pump Test. During the Automatic Leak Test, the valve and pump are checked for the following:

a. Strength of Pump (ability to start against pressure).

b. Opening and closing of valve (ability to open against High pressure and ability to fully close with Low pressure.

3.3.3 Omega 1400s With Rev 47 or Greater. In Omega 1400s with Rev. 47 or greater software, a brief test of valve speed is conducted immediately after the conclusion of a successful leak test. This test's "fail" count is shown on the INTERVAL display.

NOTE

The valve speed test can only be conducted with the correct leak test load (volume) connected. Any other volume may give false valve pass/fail indications. A 10-ft. length of 1/8" i.v. tubing will provide the correct volume for this test.

3.3.4 Omega 1400s With Rev 48 or Greater. In Omega 1400s with Rev. 48 and greater software, every second test will be a low pressure leak test. After performing the high pressure leak test and valve speed test, the monitor will inflate approximately 30 torr and begin the 30-second low pressure leak test. If the beginning and ending pressures differ by 10 torr or more, this test will be counted as a failure. The SYSTOLIC display will show the number of leak tests completed and the DIASTOLIC display will show the number of leak failures. The MEAN display will show the beginning pressure and the Pulse display will show the current pressure during the leak test.

The monitor will not perform a valve-speed test after the low pressure leak test.

3.3.5 Test-Calibration Mode 3 Exit. To exit Test-Calibration Mode 3, turn the POWER switch to the OFF position.

SECTION IV

CALIBRATION AND VERIFICATION PROCEDURES

This section describes the calibration and verification procedures which are used to maintain the Omega 1400 series of Oscillometric Monitors.

4. CALIBRATION AND VERIFICATION PROCEDURES

4.1 Calibration Checkout

4.1.1 Introduction. Refer to Section III: CALIBRATION MODES, for "cover on" checkout of the following:

- DC Offset
- Adult and Neonatal AC Offset
- Transducer Calibration
- Leak Test
- RAM Check

Should any of these calibration requirements arise from running any of the three Test-Calibration Modes, refer to the paragraph which outlines the calibration procedures for correction of the failure.

REFERENCE APPENDIX A: SCHEMATICS AND DIAGRAMS FOR COMPONENT LOCATIONS.

4.2 Power Supply Calibration

NOTE

Use ground reference at "TP Ground" on Processor board.

4.2.1 Calibration Setup. Perform the following procedure to ready the Omega 1400 monitor for calibration:

a. Connect monitor's serial port to MRI Omni-Trak, or to a 24 VDC Power Supply (negative to I/O Port Pins 14, 15 and 16; positive to I/O Port Pins 11, 12 and 13).

b. Turn Front-Panel POWER switch to the ON position.

c. Depress and release HOLD control to place monitor in the Hold mode.

NOTE

If the following adjustments to the Power Supply board are required, it may be necessary to elevate the Processor board.

4.2.2 Adjustments On Power Supply. Perform adjustments on the Power Supply board as follows:

a. With a voltmeter, monitor +5 V at J8 Pin 3 or 4, on the Processor board, and adjust R31 on the Power Supply board for 5 V, ±50 mV.

b. Verify the following voltages at J8 on Processor board:

J8, pin 8:	-8.3 V (±300 mV)
J8, pins 5 & 6:	+12 V (±500 mV)
J8, pins 3 & 4:	+ 5 V (±100 mV)
J9, pin 3:	+18V (±2 V)

4.3 Test-Calibration Mode 1

4.3.1 Introduction. This mode provides calibration of:

- DC Offset
- Adult AC Offset
- Neonatal AC Offset

4.3.2 Initiation of Test-Calibration Mode 1. To enter Test-Calibration Mode 1:

a. Turn POWER switch to the OFF position.

b. Depress and hold the START control while turning the POWER switch to the ON position.

c. When the ALARM TONE sounds, release the START control.

NOTE

The monitor will remain in Test-Calibration Mode 1 for approximately 3.5 minutes. After this time, the monitor's failsafe timer will open the valve, and the alarm will sound.

d. Observe the following indications:

(1) ALARM indicator flashes with each alarm tone.

(2) MAIN display indicates "188" then "288."

(3) INTERVAL display indicates "88."

(4) All INDICATORS (except NEONATE) are on.

(5) SYSTOLIC display indicates the DC Offset of the internal pressure transducer. This must read between 3 and 9 torr.

(6) DIASTOLIC display indicates the Adult AC Offset of the pressure transducer. This must read 80 ±5.

(7) PULSE display indicates the Neonatal AC Offset. This must read 80 ±5.

(8) The Rear-Panel VOLUME control is functional, and the Rear-Panel ALARM TONE control functions as follows:

UP POSITION:	LOW CONSTANT TONE
CENTER POSITION:	NORMAL CONSTANT TONE
DOWN POSITION:	ALTERNATING TONES

e. Within 11.5 seconds from POWER ON, the valves should close, and displays are in Calibration mode.

4.3.3 Analog Adjustments On Processor Board. Perform analog adjustments on the Processor board as follows:

REFERENCE: With a volt meter, monitor the +5 V reference voltage at "TP +5 V REF", and adjust R31 for 4.995 VDC. (±0.005 VDC).

DC OFFSET: With SENSE INPUT port open, adjust R34 for "06" in the SYSTOLIC display.

ADULT AC OFFSET: Adjust R90 for "80" in the DIASTOLIC display.

NEONATAL AC OFFSET: Adjust R32 for "80" in the PULSE display.

SENSE PORT: Using a standard mercury manometer and handbulb connected to Sense port with a "T" fitting (see Figure 3), apply 200 mmHg pressure with the handbulb. Adjust R33 for "206" in the SYSTOLIC display. Remove pressure from SENSE port.

If necessary, adjust DC offset, as described above. Then reapply pressure source, and apply the pressures listed in Table 4-1, noting values in the SYSTOLIC display:

Table 4-1: Systolic Pressures and Tolerances

INPUT PRESSURE	SYSTOLIC DISPLAY	TOLERANCE
00	06	±1
50	56	±1
100	106	±1
150	156	±1
200	206	±1

4.3.4 Failsafe Alarm Test. Perform the following procedure to that the Failsafe Alarm functions properly:

a. Turn the POWER switch to the OFF position.

b. Reenter Test-Calibration Mode 1 by depressing and holding the START switch while turning the POWER switch to the ON position.

c. Begin timing the failsafe timeout. The monitor should alarm in 3 minutes (+25/-30 seconds) from the start of elapsed time at POWER ON.

4.4 Test-Calibration Mode 2

4.4.1 Initiation of Test-Calibration Mode 2. Test-Calibration Mode 2 may be entered by two methods:

a. From Test-Calibration Mode 1:

(1) Depress and hold the START control.

(2) When ALARM TONE sounds five times, release the START control.

(3) The monitor will enter Test-Calibration Mode 2.

b. From Power Off:

(1) Depress and hold the START control, and turn the POWER switch to the ON position.

(2) When ALARM TONE sounds five times, release the START control.

(3) The monitor will enter Test-Calibration Mode 2.

REFERENCE SECTION III, CALIBRATION MODES FOR A DESCRIPTION OF THE AUTOMATIC RAM CHECK PERFORMED IN THIS MODE.

4.4.2 Analog Verification. Perform analog verification as follows:

a. Ensure ADULT/NEONATAL selector is in the ADULT position.

b. Turn Front-Panel POWER switch to the ON position.

c. Place unit in Hold mode.

d. Connect a function generator as follows:

(1) Disconnect the transducer from J3 on the Analog board.

(2) Connect a function generator to "SIGNAL" (J3, pin 3) and to "GROUND" (J1, pin 2).

e. Using oscilloscope, monitor "TP P2" test point, and verify that the following peak signals occur:

(1) Set function generator output for 2.5 Hz sinewave at 25 mV peak to peak. On oscilloscope, verify peak signal occurs at 2.5 Hz (4 V peak to peak, ±0.4 V).

(2) Adjust function generator to 0.8 Hz. On oscilloscope, verify half-peak signal (2 V peak to peak, ±0.2 V).

(3) Adjust function generator to 9 Hz. On oscilloscope, verify half-peak signal (2 V peak to peak, ±0.2 V).

(4) Set function generator output for 9 Hz sinewave at 25 mV peak to peak. On oscilloscope, verify a gain of four (4) between signal input at J3 Pin 3 and U23 Pin 1 (100 mV peak to peak, ±20 mV).

(5) On oscilloscope, verify gain of ten (10) between U23 Pin 1 and U19 Pin 1 (1 V peak-to-peak, ±200 mV).

(6) On oscilloscope, verify gain of two (2) between U28 Pin 1 and "TP P2" (2 V peak to peak, ±400 mV).

(7) On oscilloscope, verify gain of eight (8) between U19 Pin 1 and "TP AC", (8 V peak to peak, ±1.6 V).

4.4.3 Transducer Verification. Perform transducer verification as follows:

NOTE

If the transducer is noisy, the noise will appear as a low-frequency jumping off of center (popcorn noise), rather than a high-frequency white noise. Popcorn noise in excess of 200 mV will require that the transducer be replaced to prevent inaccurate readings.

"Popcorn" noise may only occur every 15 seconds; therefore, monitor this test point at least 15 seconds.

a. Reconnect the transducer to J3 of the Processor Board.

b. Set Oscilloscope to 50 mV per division and monitor "TP AC" test point.

c. Verify that noise is less than 200 mV peak-to-peak. This test should be conducted with no pressure in the pneumatic system.

4.4.4 Alarm and Hold-Mode Verifications. Perform Alarm and Hold verification as follows:

a. Open SENSE and INFLATE ports.

b. Depress and release the START control.

c. Monitor will ALARM at the end of the Pump Cycle.

d. Depress and release the HOLD control.

e. Verify that the Alarm Condition is Cancelled.

f. Depress and release the HOLD control.

g. Verify the following:

(1) The monitor enters the Hold mode.

(2) HOLD indicator is illuminated.

(3) DIASTOLIC display indicates a blinking "01" (time in Hold).

h. Depress and release the START control.

i. Verify the following:

(1) The monitor exits the Hold mode and the Pump Cycle begins.

NOTE

R18 on the Rear Panel Control board controls the touch tone volume.

(2) An audible Touch Tone is heard each time the START control is depressed.

j. Depress and release the HOLD control.

k. Verify that the monitor enters the Hold mode.

4.4.5 Overpressure Switch Adjustment. As a pneumatic system safety feature, the Omega 1400 employs an Overpressure Switch, which senses successive system pressures and turns the monitor off until the overpressure situation has cleared. This switch has adjustable pressure trip-points, and may require occasional checks and readjustments, especially when the monitor has been exposed to high vibration situations.

Perform Overpressure Switch adjustment as follows:

REFERENCE EXPLODED VIEW, DRAWING 97D270 (APPENDIX A, PAGE A-4, ITEM 40) FOR LOCATION OF OVERPRESSURE SWITCH.

a. Connect a mercury manometer and hand-bulb to the Inflate port with a "T" fitting.

b. Open the hand-bulb valve.

c. Depress and release the START control.

d. Slowly close the hand-bulb valve while monitoring the pressure on the manometer.

NOTE

Increase the pressure at a rate not greater than 2 mmHg/second towards the activation (monitor power-down) point. Increasing pressure too rapidly will give a false trip-point indication.

e. Adjust the Overpressure Switch to activate (power-down monitor) at 270 mmHg (±14 mmHg).

4.4.6 Digital Manometer Verification. Perform Digital Manometer Verification as follows:

a. Depress and hold the HOLD control.

b. Verify that upon second audible touch tone, the "ALT = D. MANOMETER" indicator begins to blink.

c. Start elapsed timing when valve closure is heard.

d. Verify that the monitor automatically exits the Manual Manometer mode with an audible tone in 60 (±2) seconds from the start of elapsed time.

e. Connect a mercury manometer and handbulb to the Sense port on the front panel of the monitor.

f. Re-enter the Manual Manometer mode by depressing and holding the HOLD control.

g. With the hand-bulb, apply 250 mmHg.

h. Verify that the Mean display is showing 249 (±1) torr.

NOTE

The peak pressure value displayed in the MEAN display is 255 (maximum reading) minus DC Offset.

4.5 Test-Calibration Mode 3

4.5.1 Initiation of Test-Calibration Mode 3. To enter Test-Calibration Mode 3:

a. Close the pneumatic circuit by connecting the patient hose and cuff to the SENSE and INFLATE ports, and wrapping the cuff tightly around itself.

b. Turn the POWER switch to the OFF position.

c. Depress and hold the HOLD control while turning the POWER switch to the ON position.

d. The monitor will begin the automatic leak test. The test will repeat until interrupted.

4.5.2 Automatic Leak Test. The monitor will inflate approximately 200 torr and begin a 30-second leak test. If the beginning and ending pressures differ by 10 torr or more, this test will be counted as a failure. The SYSTOLIC display will show the number of leak tests completed and the DIASTOLIC display will show the number of leak failures. The MEAN display will show the beginning pressure and the PULSE display will show the current pressure during the leak test.

4.5.3 Alarm Function Test (Adult Mode).

NOTE

For general information on the functioning of the alarms and setting alarm parameters, see Section I: Operation, ALARMS section.

4.5.3.1 Alarms Parameter Select Verification. Perform Alarms Parameter Select Verification as follows:

a. Ensure that the monitor is in the Adult mode.

b. Turn the Front-Panel POWER switch to the ON position.

c. Depress and release the HOLD control.

d. Verify ALARM ACTIVE indicator is illuminated.

e. Depress and release the Alarms SELECT control.

f. Verify the following:

(1) Touch Tone sounds.

(2) MEAN display alternates between 135 and 55 (preset limits).

g. Depress and release Alarms SELECT control.

h. Verify the following:

(1) Touch Tone sounds.

(2) SYSTOLIC display alternates between 190 and 65 (preset limits).

i. Depress and release Alarms SELECT control.

j. Verify the following:

(1) Touch Tone sounds.

(2) DIASTOLIC display alternates between 125 and 40 (preset limits).

k. Depress and release Alarms SELECT control.

l. Verify the following:

(1) Touch Tone sounds.

(2) PULSE display alternates between 160 and 45 (preset limits).

m. Depress and release Alarms SELECT control.

n. Depress and hold Alarms ON/OFF control.

o. Verify the following:

(1) All alarms are reset to 255/00

(2) Alarms ACTIVE indicator extinguishes.

p. Release Alarms ON/OFF control.

q. Depress and release Alarms ON/OFF control.

r. Verify Alarms ACTIVE indicator illuminates.

s. Verify HI SET and LO SET will change alarm parameters in any one display.

4.5.3.2 "Dead-Man" Alarm Test. Perform the "Dead-Man" alarm test as follows:

a. Close the pneumatic circuit by connecting the patient hose and cuff to the SENSE and INFLATE ports, and wrapping the cuff tightly around itself.

b. Depress and release the START control.

c. When the CYCLE Lamp illuminates, start elapsed time.

d. Verify that unit alarms in less than 75 seconds.

4.5.3.3 Pneumatic Impedance Test. Perform the pneumatic impedance test as follows:

a. Close the pneumatic circuit by connecting the patient hose and cuff to the SENSE and INFLATE ports, and wrapping the cuff tightly around itself.

b. Depress and release the START control.

c. Monitor will inflate cuff.

d. When monitor has stopped pumping, immediately depress and release the HOLD control.

e. Verify that the unit enters the HOLD Mode.

f. When "01" appears in the DIASTOLIC display, depress and release the START control and start elapsed time.

g. Verify the pump reactivates within 5 seconds.

h. Depress and release the HOLD control.

4.5.3.4 Interval Verification and Test. Perform the interval verification and test as follows:

a. Depress and release the HI SET control.

b. Verify the following:

(1) Touch Tone sounds.

(2) INTERVAL display increments by one.

c. Repeat until "ones" position in INTERVAL display indicates "9".

d. Depress and hold the HI SET control.

e. Verify that the INTERVAL display increments by 10's, up to "99".

f. Release the HI SET control.

g. Depress and release the LO SET control.

h. Verify the following:

(1) Touch Tone sounds.

(2) INTERVAL display decrements by one.

i. Repeat until "ones" position in INTERVAL display indicates "0".

j. Depress and hold the LO SET control.

k. Verify that the INTERVAL display decrements by 10's, down to "00".

l. Release the LO SET control.

m. Depress and hold the LO SET control.

n. Verify a continuous Touch Tone.

o. Release the LO SET control.

4.5.3.5. Verification of Alarm with Neonatal Cuff Used in Adult Mode. Perform verification of alarm with the neonatal cuff used in adult mode as follows:

a. Connect neonatal cuff and hose to SENSE and INFLATE ports.

b. Ensure the ADULT/NEONATE selector is in the ADULT position.

c. Turn the POWER switch to the ON position.

d. Depress and release START control.

e. Verify that the pump runs for less than 3 seconds, and monitor alarms. This indicates that the monitor has sensed the small volume of the neonatal hose and cuff, and since it was in the ADULT mode, has alarmed.

4.5.3.6 Adult/Neonate Selector Lock-Out. Test the adult/neonate selector lock-out as follows:

a. Place the ADULT/NEONATE selector in the ADULT position.

b. Turn the POWER switch to the ON position.

c. Switch the ADULT/NEONATE selector to the NEONATE position.

DEFINITION: LOCK UP means total loss of operator control, with monitor remaining in constant alarm.

d. Verify the following:

(1) The monitor alarms.

(2) All displays show "00".

(3) Monitor locks up.

e. Turn the POWER switch to the OFF position.

4.5.4 Alarm Function Test (Neonate Mode).

NOTE

For general information on the functioning of the alarms, see Section I. Operations, Alarms section.

4.5.4.1 Alarm Select Verification. Perform alarm select verification as follows:

a. Turn the POWER switch to the OFF position.

b. Set the ADULT/NEONATE selector in the NEONATE position.

c. Turn the POWER switch to the ON position.

d. Verify that Alarms ACTIVE indicator is illuminated.

e. Depress and release Alarms SELECT control.

f. Verify the following:

(1) Touch Tone sounds.

(2) MEAN display alternates between "100" and "30" (the preset alarm limits).

g. Depress and release Alarms SELECT control.

h. Verify the following:

(1) Touch Tone sounds.

(2) SYSTOLIC display alternates between "130" and "40" (the preset alarm limits).

i. Depress and release Alarms SELECT control.

j. Verify the following:

(1) Touch Tone sounds.

(2) DIASTOLIC display alternates between "80" and "25" (the preset alarm limits).

k. Depress and release Alarms SELECT control.

l. Verify the following:

(1) Touch Tone sounds.

(2) PULSE display alternates between "220" and "60" (the preset alarm limits).

m. Depress and release Alarms SELECT control.

n. Depress and hold the Alarms ON/OFF control

o. Verify the following:

(1) All alarms alternate between "255" and "00" (this indicates that alarms are inactive).

(2) Alarms ACTIVE indicator extinguishes.

(3) HI SET and LO SET controls change alarm limits on any one parameter.

4.5.4.2 Neonate Mode Non-Patient Reading Verification. Perform the neonate mode non-patient reading verification as follows:

a. Place neonatal cuff on finger.

b. Connect neonatal hose to SENSE and INFLATE ports of monitor.

NOTE

Neonatal cuff must be wrapped tightly around finger, and hand must be elevated above shoulder level to Ensure that pressures will be within the neonatal range.

c. Depress and hold START control until two Touch Tones are heard.

d. Verify that pulse and blood pressure parameters are displayed on the front panel.

4.5.4.3 Verification of Alarm With Adult Cuff Used in the Neonate Mode. For Verification of alarm with adult cuff used in the neonate mode perform the following:

a. Turn POWER switch to the OFF position.

b. Connect adult cuff and hose to SENSE and INFLATE ports on front of monitor.

c. Verify that the ADULT/NEONATE selector is in the NEONATE position.

d. Turn the POWER switch to the ON position.

e. Depress and release the START control.

f. Verify the pump runs less than five seconds and monitor alarms. This indicates the monitor has sensed the larger volume of the adult cuff and hose, and since it was in the Neonate mode, has alarmed.

SECTION V

TROUBLESHOOTING

This section outlines the procedures to follow in the event of an Omega 1400 system failure.

5. TROUBLESHOOTING

CAUTION

If correct operation of the Omega 1400 is in question, **remove it from clinical service immediately**. It should then be returned to qualified service personnel for repair.

FOR COMPONENT LOCATIONS, REFERENCE APPENDIX A SCHEMATICS AND ASSEMBLY DRAWINGS

5.1 Initial Inspection

Many of the cases in which an Omega 1400 monitor exhibits erroneous readings (or no readings at all), are caused by the various forms of artifact. **Table 5-1:** ***"Probable Causes of Monitor Being Unable to Determine Pressures"*** contains a list of the various artifact - either from the patient, external from motion or other problems - which could cause the monitor to exhibit failure indications. Refer to **Table 5-1** first, then if unable to determine cause proceed to paragraph 6.2.

5.2 Operation Checkout

5.2.1 Visual Inspection. Perform a visual inspection as follows:

NOTE

Visual Inspection should be performed in entirety. Correct any discrepancies which are uncovered before moving on to the next inspection step.

a. Inspect the monitor externally for obvious discrepancies (such as visible damage, cracks or debris) which could cause failure.

Table 5-1: Probable Causes of Monitor Being Unable to Determine Pressures

PROBLEM	PROBABLE CAUSE
Motion Artifact	1. Patient movement 2. Cuff movement 3. Hose movement
Signal Artifact	1. Erratic heart rate or pulse 2. High electrical noise environment 3. Large room-pressure changes 4. Highly-variable blood pressure on a beat to beat basis.
Weak Pulse Amplitude (Not low blood pressure)	1. Low cardiac output 2. High vascular tone 3. Arteriosclerotic vessels 4. Patient in shock 5. Deep anesthesia 6. Obesity 7. Weak Pulse
Low Oscillation Amplitude (to the monitor)	1. Cuff too loose 2. Improper cuff placement 3. Hose not connected properly
Low Inflation Pressure (under Systolic)	1. The patient's systolic pressure is higher than the monitor has inflated the cuff. (This might occur during intubation, at surgical stimulation, etc.)
High Inflation Pressure (over Systolic)	1. The patient's systolic pressure is much lower than the monitor has inflated the cuff. (This might occur as patient is being anesthetized, for example.)

b. Open the monitor and inspect internally for obvious discrepancies.

c. Inspect fuses and holders for obvious discrepancies (such as discolorization and/or corrosion).

d. Inspect cable connectors for connection integrity.

e. Inspect all interior components for mechanical soundness.

5.2.2 Operational Checkout. Perform an operational checkout as follows:

a. Apply power to the monitor.

b. Operate until fault is observed or until satisfied that no fault exists.

(1) If no fault is observed, return monitor to service.

(2) If fault is observed, proceed to step c.

c. Perform Test-Calibration Mode 3 (Section III, paragraph 3.3).

(1) If Test-Calibration Mode 3 reveals a problem with the pneumatic system, proceed to Section IV, paragraph 4.5 and perform the necessary adjustments to correct the problem.

(2) If Test-Calibration Mode 3 does not reveal a problem with the pneumatic systems, perform the manual pneumatic checks contained in paragraph 5.3.1.

(3) If the manual pneumatic systems test checks good, proceed to paragraph 5.3 Systems Troubleshooting.

5.3 Systems Troubleshooting

NOTE

The most probable area of failure is the pneumatic system. Therefore, perform paragraph 5.3.1 before proceeding to other fault isolation paragraphs.

5.3.1 Pneumatic Leaks. To determine if leaks are present in the Omega 1400 pneumatic system, perform the following procedure:

a. Connect a cuff and air hose to the monitor.

b. Wrap cuff tightly around a hard 3" cylinder or other suitable hard surface.

c. Attach a handbulb to the rear-panel Manometer port.

d. Turn the monitor ON.

e. Press and hold the HOLD control until two alarm tones sound and the "ALT = D. MANOM" indicator is illuminated.

NOTE

The monitor is now in the Manual Manometer mode. Cuff pressure is displayed in the MEAN display.

f. Use the handbulb to bring the cuff pressure up to approximately 200 torr.

g. Sharply kink the hose leading to the handbulb to preclude any leakage.

h. Monitor cuff pressure and verify that it does not drop more then 20 torr per minute.

i. Depress and release the START control to remove the monitor from the Manual Manometer mode.

j. Allow the monitor to operate through a normal reading cycle.

k. Repeat steps a through j four times.

(1) If the cuff pressure remains within the 20 torr per minute tolerance, proceed to paragraph 5.3.1.1.

(2) If the cuff pressure does not remain with tolerance, proceed to paragraph 5.3.1.2.

5.3.1.1 It is unlikely that there are any leaks in the pneumatic system. Proceed to the paragraph indicated by the observed problem to troubleshoot the monitor.

5.3.1.2 The places where a leak could occur are listed below:

- Transducer
- Dump Valve
- Pump
- Overpressure Switch
- Any of the connecting joints in the pressure tubing.

Follow the procedure listed below to isolate the leaky component:

a. Go to each component listed above, kink the tubing leading to it and perform steps a through h of the manual leak test listed above.

b. If the cuff pressure remains within tolerance, refer to paragraph 5.3.1.4; if the leak persists after all components have been tested, perform step c.

c. Work back through all the fittings by kinking the tubing and perform steps a through h of the manual leak test listed above until the leak is isolated.

d. If the leak is isolated, repair the faulty section; if the leak is not isolated or if the leak is intermittent, perform paragraph 5.3.1.3.

NOTE

When the monitor is not in service, it is recommended that the user keep the red-plastic end caps provided with the monitor on the Sense, Inflate and Manometer ports.

5.3.1.3 Intermittent pump and valve leaks can be caused by dust and fine particulate contaminants in the pneumatics system. If leak problems are known to exist, but cannot be duplicated during troubleshooting, pump and/or valve replacement is recommended.

5.3.1.4 If a component is identified as needing replacement, check the appropriate assembly drawing in Appendix A for the correct part number for ordering. Be sure to use Loc-Tite when reinstalling screws.

5.3.2 Overpressure Switch. See Section IV: Calibration and Verification Procedures, for adjustment and verification.

FOR REPLACEMENT, REFERENCE EXPLODED VIEW DRAWING 97D270 (APPENDIX A, PAGE A-4, ITEM 40)

5.3.3 Noisy Pressure Transducer. See Section IV: Calibration and Verification Procedures, for adjustment and verification.

FOR REPLACEMENT, REFERENCE EXPLODED VIEW DRAWING 97D270 (APPENDIX A, PAGE A-4, ITEM 10)

5.3.4 Power Supply. See Section IV: Calibration and Verification Procedures, for adjustment and verification.

5.3.5 Electronic Circuits. Many of the Omega 1400's electronic circuits are tested in the Calibration Modes (detailed in Section III) and the Calibration and Verification Procedures (detailed in Section IV). When electronic failure is suspected: perform all three Test-Calibration Modes contained in Section III, and then confirm correct calibration of the monitor using procedures outlined in Section IV.

5.3.5.1 IC Replacement. If it is determined that any memory Integrated Circuit (IC) is defective, it may be easily replaced, as these IC's are in sockets on the Processor board. Also, the ADC and microprocessor IC's are in sockets for easy substitution or replacement.

5.3.5.2 Board Level Troubleshooting. In the event electronics problems persist, a thorough checkout of each subsystem should be performed (i.e., Power Supply board, Processor board, Display board, Rear Panel Control board and Pump-Drive) to narrow the field of trouble to the board

level. Refer to **Table 5-2** for board level troubleshooting procedures.

5.3.5.3 Component Level Troubleshooting. Field repair at the component level will require a through knowledge of microprocessor system functions, as well as familiarity with the various system-support IC's. This is beyond the scope of this manual and is left to the individual technician.

Table 5-2: Board Level Troubleshooting Procedures

MEASUREMENT/ACTION	IF GOOD	IF BAD
1. Using Voltmeter, perform the following measurements on J11 of the Power Supply Board: Pins 3 and 4: 5.1 V (±25 mV) Pins 5 and 6: 12 V (±0.5 mV) Pin 8: -8.3 V (±0.5 mV)	Go to step 2.	Replace AB08F2 Power Supply Board.
2. Perform Power On Initial Test:		
a. Observe test sequence.	Go to step 2b.	Replace AB08A Processor Board.
b. All LED segments and indicators illuminate.	Go to step 2c.	1. Check for bent pins on P1 and P2 of AB08C Display Board. 2. Replace segment or Indicator. 3. Replace AB08C Display Board.
c. Alarm tone sounds.	Go to step 2d.	Replace AB08D Rear Panel Control Board.
d. Alarm tone sounds correctly.	Go to step 2e.	Replace speaker on AB08D Rear Panel Control Board.
e. Touch tone (beep) sounds.	Go to step 2f.	1. Replace AB08D Rear Panel Control Board. 2. Replace AB08A Processor Board.

MEASUREMENT/ACTION	IF GOOD	IF BAD
f. Monitor transfers control to Omni-Trak (goes into Hold).	Go to step 3.	1. Ensure that AB20A Protocol Converter Board is properly plugged in. 2. Replace AB20A Protocol Converter Board.
3. Using Voltmeter, measure 5 V Ref at TP5VR on Processor Board.	Go to step 4.	Replace AB08A Processor Board.
4. Initiate Test/Calibration Mode 1 (see paragraph 3.1).		
a. Monitor enters Test/Calibration Mode 1.	Go to step 4b.	1. Adjust DC Offset (see paragraph 4.3.3). 2. Replace AB08A Processor Board.
b. PULSE display is steady (not jumping).	Go to step 4c.	Replace A537 Transducer Board.
c. Connect Handbulb to SENSE port and pump SYSTOLIC display to 206.	Go to step 4d.	1. Adjust DC Gain. 2. Replace AB08A Processor Board.
d. DIASTOLIC and PULSE displays indicate 80.	Go to step 5.	Replace AB08A Processor Board.
5. Perform RAM test (see paragraph 3.2.2).	Go to step 6.	Replace AB08A Processor Board.
6. Using slightly open handbulb and Manometer, pump up manometer to 270 (Overpressure Check).		
a. Monitor resets itself (overpressures).	Go to step 7.	1. Perform Overpressure Switch adjustment (see paragraph 4.4.5) 2. Replace Overpressure Switch.

MEASUREMENT/ACTION	IF GOOD	IF BAD
7. Set up monitor for normal operation, apply power. Omni-Trak has control over monitor.	Go to step 8.	Replace AB20A Protocol Converter Board.
8. Return monitor to service.		

SECTION VI

ORDERING PARTS

This section outlines the procedures to utilize for ordering replacement parts.

6. ORDERING PARTS

6.1 Ordering Procedure

Spare parts may be ordered directly from Invivo Research Laboratories.

To order include the following:

a. Your mailing address including mail stop.

b. Invivo Part Number and Description of the part.

c. Serial Number of the Monitor for which the parts are being ordered. ***This is especially important when ordering major assemblies (such as printed circuit boards, power supplies, pumps, or transducers) to ensure that you receive the correct revision part.***

NOTE

As new parts are installed in the Omega 1400, note that all metal-to-metal screws have had Loc-Tite applied at the factory. Loc-Tite must be reapplied to any screws removed in the field to insure the mechanical and electrical integrity of the monitor.

6.2 Factory Authorized Service

Should factory service be desired, contact:

Technical Service Department
Invivo Research Incorporated
12601 Research Parkway
Orlando FL 32826

Call Customer Service Toll Free: 800-331-3220

Invivo also maintains Authorized Service Representatives throughout the United States; contact the Invivo Research Incorporated Technical Service Department at the above number for the location nearest you.

APPENDIX A: REFERENCE DRAWINGS

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INTERRUPT GENERATOR U12

INT

1 MHZ

SYSTEM CLOCK 4 MHZ

2 MHZ

CLK

UP U11

I/ORQ

RD

WR

MEMR

MEMORY SELECT U5

A13,14,15

EPROM U15

RAM U21 & 26

I/O SELECT U10

ADDRESS BUSS

A0 & A1

DATA BUSS

SYSTEM REQUEST

RESET

OUTPUT LATCH BUFFER U3

I/O SELECT LINES

DC

ADULT

AC

ACG

NEO

AC

ACG

TRANSDUCER

SENSE PORT

+5 V REFERENCE

ADC U25

OUTPUT LATCHES U1,2,7,8,9

INPUT BUFFER U24

REAL TIME CLOCK U27

RESET

FAILSAFE TIMER U16 & 17

F.S. OSC.

TOUCH TONE

ALARM CONTROL

ALM

ALM BLK

REAR PANEL I/O PORT

PUMP AND VALVE CONTROL

REAR PANEL ALARM OSC. & CONT.

SWITCHING POWER SUPPLY

LINE

BATT

+5 V

+12 V

−8 V

AC IN

AUTOMATIC CHARGER

+

−

BATT

DC POWER SWITCH

OVER PRESS SW

PUMP DRIVE

DC PUMP

VALVE

INFLATE PORT

ALM/TONE AMP

SPEAKER

FRONT PANEL DISPLAYS & L.E.D.'s

20 COLUMN PRINTER

FRONT PANEL SWITCHES

LOC. | PART NO. | NO. REQ'D. | DESCRIPTION | MATL. REQ'MT

TOLERANCES

DRAWN | CHECKED | DESIGNED | SELECT ASSEMBLY | APPROVED

Ivytro Research Laboratories Inc.

FUNCTION BLOCK DIAGRAM OMEGA 1400

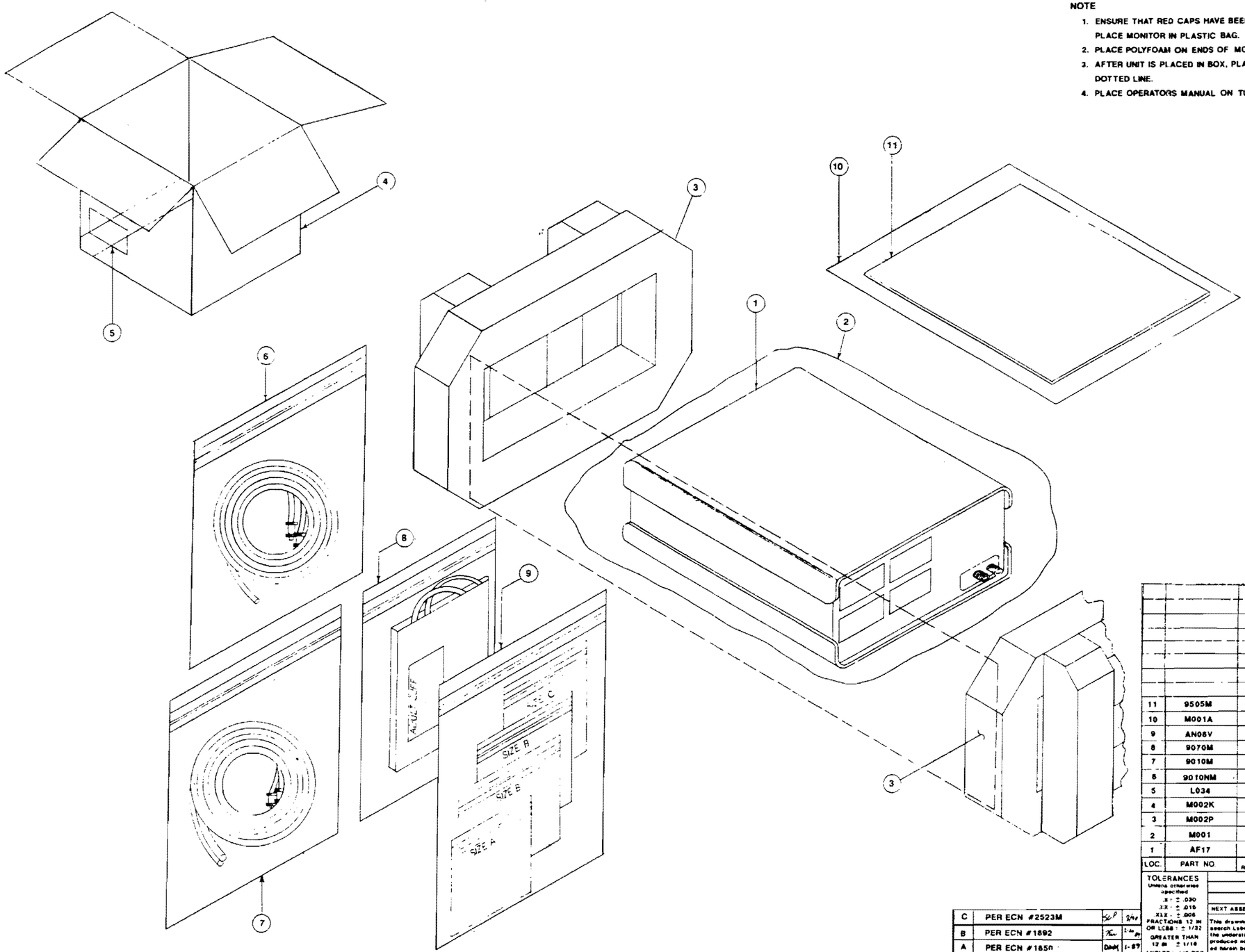
SCALE | SHEET | DWG. NO. | REV.

NA | 1 OF 1 | 97D149 | D

LTR | REVISION | BY | DATE

NOTE

1. ENSURE THAT RED CAPS HAVE BEEN PUT ON THE PORTS (3) OF THE MONITOR. THEN PLACE MONITOR IN PLASTIC BAG.
2. PLACE POLYFOAM ON ENDS OF MONITOR, THEN PUT INTO BOX.
3. AFTER UNIT IS PLACED IN BOX, PLACE ITEMS 6 THRU 9 IN AREA DESIGNATED BY DOTTED LINE.
4. PLACE OPERATORS MANUAL ON TOP OF MONITOR.



LOC.	PART NO.	NO. REQ'D	DESCRIPTION	MAT'L. REQ'MT.
11	9505M	1	MANUAL, OPERATORS, OMEGA 1400, MRI	
10	M001A	1	BAG, MANUAL, 10 X 15	
9	AN08V	1	CUFF, DISP, SIZE A-B-C, OMEGA 1400	
8	9070M	1	CUFF, ADULT, TAPER FIT, MRI	
7	9010M	1	HOSE, ADULT, TWIN LUMEN, 18', MRI	
6	9010NM	1	HOSE, NEONATAL, 18', MRI	
5	L034	1	LABEL, SHIPPING, OMEGA	
4	M002K	1	BOX, 14.5 X 13.8 X 6.4, OMEGA	
3	M002P	2	POLYFOAM N95 OMEGA 1400/5000	
2	M001	1	BAG, CLEAR, 20 X 24	
1	AF17	1	OMEGA 1400/MRI	

LTR	REVISION	BY	DATE
C	PER ECN #2523M		
B	PER ECN #1892		
A	PER ECN #1850		

TOLERANCES
Unless otherwise specified
.X ± .030
.XX ± .010
.XXX ± .005
FRACTIONS 12 IN OR LESS ± 1/32
GREATER THAN 12 IN ± 1/16
ANGLES 1/2 DEG
FINISHES 125

DRAWN SIR 11/86
CHECKED 11/86
DESIGNED 11/86
NEXT ASSEMBLY
APPROVED 11/87

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Invivo Research Laboratories Inc.
Pioneers Biomedical Instruments

OMEGA, 1400/MRI , 3103-1

SCALE	SHEET	DWG. NO.	
N/A	1 OF 1	97D276	C

ASSEMBLY NOTES

1. APPLY BLUE LOCTITE (#M006) TO ALL NUTS AND SCREWS, EXCEPT THE NUTS ON THE OVERPRESSURE SWITCH.

ITEM #	PART #	QTY	DESCRIPTION
1	AB08A3	1	PCA, SNIBP, CORO 555/1400 SERIES
2	AB08C	1	PCA,Display,OM 1400
3	AB08D	1	PCA,Rear Panel Control,OM 1400
4	M092	20"	TAPE, SHIELDING, COPPER 1" WIDE
5	AB08F2	1	PCA, POWER, 1400 MRI MIBP OPTION
6	AP07	1	Hose Adapter,MQC-3
7	AP15	1	Bracket,Patient Hose,OM5/1400
8	AP20	1	Valve,Humphrey,OM 1400
9	AP21	1	Pump/Pump Drive PCA,OM 1400
10	AS37	1	Transducer,Omega 1400
11	M109	19"	GASKET, EMI/EMP, CONDUCTIVE ELASTOMER
12	LO54	2	LABEL,WARNING,NIBP, MRI
13	HM07A2	1	Chs,Omega 1445 ,Cover
14	HM07B2	1	Chs,Omega 1445 ,Bottom
15	HM07C	1	Chs,Omega 1400,Faceplate
16	HM07P	1	CHS, OM 1400 120V , SIDES & BACK, MRI
17	PA186	1	GASKET, EMI/RI, 25 PIN
18	HM07H	1	Chs,Omega 1400,Power Supply Bracket
19	PA142	1	Filter, 25 Pin, 50 Series
20	HM07K	1	Chs,Omega 1400,Processor Bracket
21	NS13	1	#6-32 x 7/8" Ph Pnh Pld Zinc
22	HO26	1	KNOB, PK-1100B-1/4
23	L4001C	1	Overlay,Omega 1400 NIBP , MRI
24	NS63	14	SCREW, 6-32 X 1/4 PH FLHD ZINC PLD
25	L4003A	1	Label,Abbr Op Inst,Omega 1400 ENGLISH
26	LO14	1	Label,"Accepted" W02
27	HS06	1	Spacer, .5" x #6 Clearance 4019
28	L1016B	1	LABEL, SERIAL, 15-30V OMEGA SERIES
29	NS02	15	6-32 X 1/4" PH PNH PLD Zinc
30	NS04	4	4-40 x 1/4" PH PNH PLD ZINC
31	NS06	2	6-32 X 1/2" PH PNH PLD Zinc
32	NS09	1	6-32 X 1/2" Set Screw
33	NS10	4	6-32 X 3/8" PH PNH PLD Zinc
34	NS17	2	#4-40 X 1/2" PH PNH PLD ZINC
35	NS60	7	6-32 X 3/8" PH FLH ZINC PLD
36	NW01	2	Lockwasher,Int Tooth,#6,SS
37	NW09	4	Lockwasher,Int Tooth,#4,SS
38	N001	14	Nut: 6-32 X 1/4" Hex,Plated
39	N002	2	Nut: 4-40 X 1/4" Hex,Plated
40	S007D	1	Switch,Over Pressure,Adult, DC
41	SO16	2	Switch,Power,Snap-In 1852.1125R52
42	AB20A	1	PCA, Protocol, 1400/ OMNI-BUSS
43	AC82	1	Cable, Transducer, 1400/2120
44	AS93	1	Cable Assy, Input/Output MRI/1400
45	HS02	1	Spacer 2.25" X 6-32 1642
46	HS12	2	Spacer 4.10" X 6-32
47	FE01	2	Feet,Black SJ-5514
48	FE02	4	Feet,Gray SJ-5012
49	FE04A	1	Stand,Tilt,Plated
50	H001	4	Shock Absorber #6-32 X 1/2"
51	NW05	8	Metal #6 X 5/16" OD
52	HC02	1	Clamp,Nygrip 3/8-4 NA
53	HP09	24 1/2"	Tubing,SBR .125" X .064"
54	HH01	1	Handle,Omega A944-20
55			
56			
57	HS29	1	Spacer .437" X #6
58	AW87	1	Black,20G,10",1400,SO16-S007A
59	AW90	1	Blue,18G,3.5",1400,SO16-HE03
60	AM13A	1	PROM SET, PROTOCOL, OMNI-BUS
61	AC13	1	Cab I/O Port,Universal
62	AC72	1	Cab Alarm ,OM1400
63	AC83	1	Cab Power,OM1400
64	AC74	1	Cab Display,OM 1400
65	AC75	1	Cab Pump,OM 1400
66			
67	SO15	1	Switch,Rocker 1803-1121
68			
69	AC79	1	Cab Frontpanel Pwr Sw,OM 1400
70	AC80	1	Cab Adult/Neonatal,OM 1400
71			
72	HP05	3	Fitting,"Tee" Plastic J-3
73			
74	AC70	1	Cab Ribbon,16 pin,6",OM 1400
75	AC69	1	Cab Ribbon,14 pin,12",OM 1400
76	M001	1	Bag,clear 20" X 24" X .002"
77			
78	HC01	1	Clamp,Nygrip 1/4-4 NA
79	M005	3	Capsred,Sinclair .281 X .5
80	WT05	1/2"	Heat Shrink 3/16" OD black
81	M004	2"	Tape, DS 1/2" X .010" Y9473
82	NW02	2	Nylon , .140" .312" X .032"
83	HS28	2	Standoff 4-40 X .375" Male/Female
84	NW07	2	Lockwasher , 3/8" L-E062

LTR | REVISION | BY | DATE
J | PER ECN NO. 3517 | | 5/93
H | PER ECN NO. 3482 | |
G | PER ECN NO. 3235 | |
F | PER ECN #2860 | |
E | PER ECN #2789M | |
D | PER ECN #2575 | |
C | PER ECN #2099M | |
B | PER ECN #1744 | |
A | PER ECN #1558 | |

LTR | DESCRIPTION | DRAWN | CHECKED | DESIGNED | NEXT ASSEMBLY | APPROVED | NO. REQ'D | PART NO. | LOC | MAT'L REQ'MT.

TOLERANCES Unless otherwise specified: XXX = ± .005 FRACTIONS 12 IN OR LESS = ± 1/32 GREATER THAN 12 IN = ± 1/16 ANGLES = 1/2 DEG FINISHES 125

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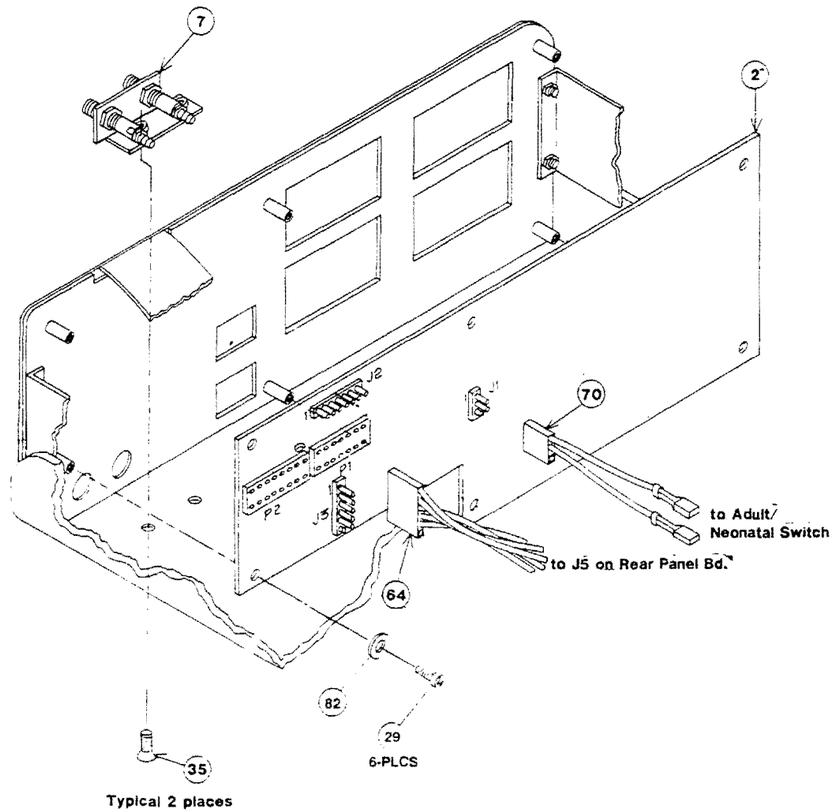
Invivo Research Laboratories Inc.
Precision Biomedical Instrument

SCALE 1/2 | SHEET 5 OF 5 | DWG NO. 97D270 | REV. J

OMEGA 1400/MRI #AF17

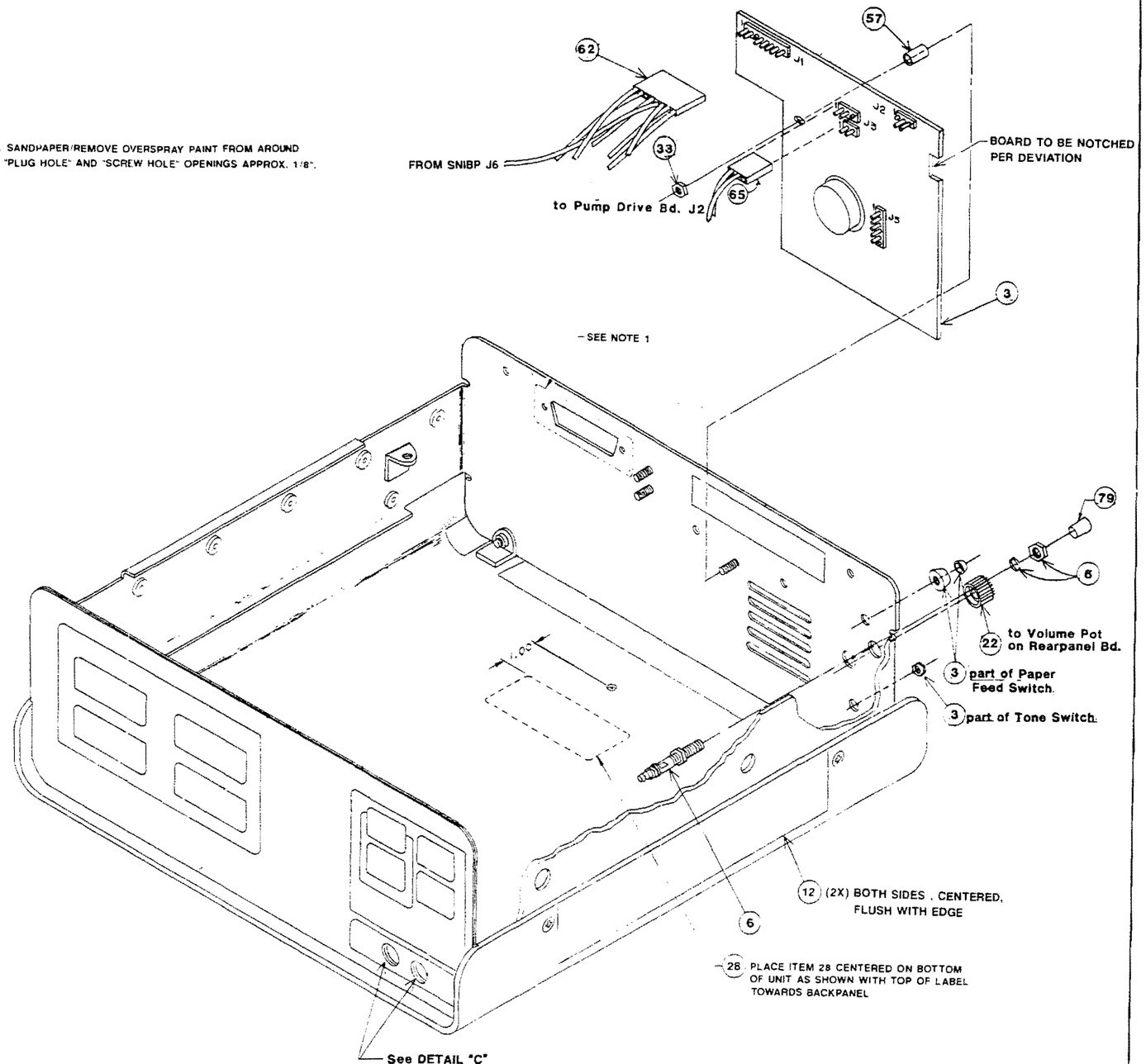


DETAIL "C"

Frontpanel Assembly (con't.)

NOTE:

1. SANDPAPER/REMOVE OVERSPRAY PAINT FROM AROUND "PLUG HOLE" AND "SCREW HOLE" OPENINGS APPROX. 1/8".



LOC.	PART NO.	NO. REQ'D.	DESCRIPTION	MAT'L. REQ'MT.

TOLERANCES
Unless otherwise specified
.X : ± .030
.XX : ± .015
.XXX : ± .005
FRACTIONS 12 IN OR LESS : ± 1/32
GREATER THAN 12 IN : ± 1/16
ANGLES : 1/2 DEG
FINISHES 125

DRAWN
CHECKED
DESIGNED
NEXT ASSEMBLY
APPROVED

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Precision Biomedical Instruments

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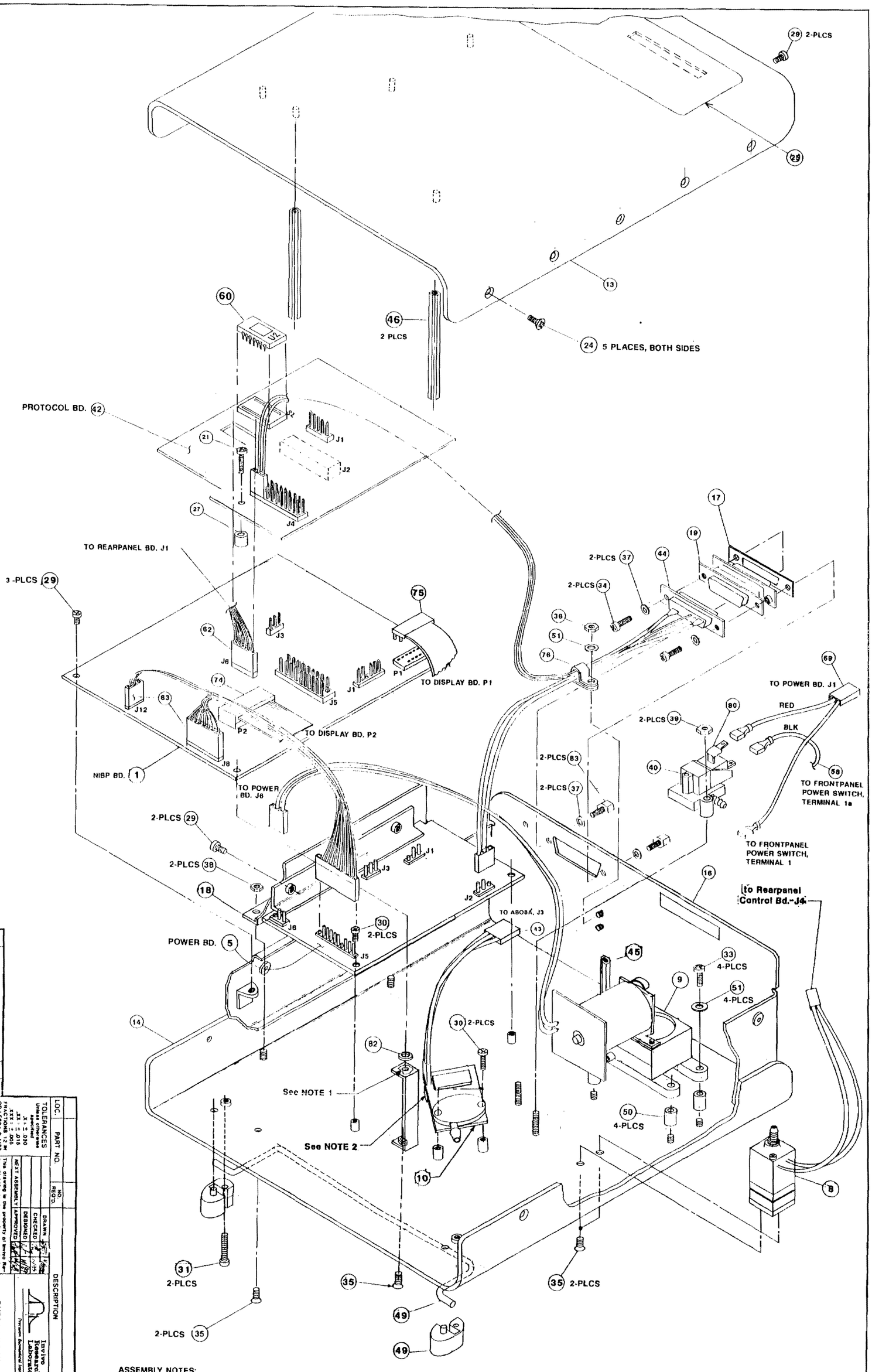
OMEGA 1400/MRI #AF17

LTR	REVISION	BY	DATE

SCALE	SHEET	DWG. NO.	REV.
,	3 OF 5	9/D270	J



ASSEMBLY NOTES:

1. SECURE WASHER (NW02) TO BRACKET USING LOCTITE #411 ADHESIVE.
2. BEFORE INSTALLING TRANSDUCER, REMOVE BACKING FROM TAPE ON BOTTOM OF TRANSducer.

LTR	REVISION	BY	DATE

LOC.	PART NO.	NO. REQ'D.	DESCRIPTION	MATL. SPEC.

TOLERANCES
Unless otherwise specified
.XX: ± .010
.XXX: ± .005
ANGLES: 1/2 DEG
FINISHES: 125 µ

DRAWN
CHECKED
DESIGNED
APPROVED

NEXT ASSEMBLY

Ivorine Research Laboratories Inc.
Precision Biomedical Instruments

SCALE: 1/4
SHEET 1 OF 1

OMEGA 1400/MRI #AF17-

DWG. NO. 97D270

REV. J

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Wires to be contained in this clamp are the cable wires from the Power Board at J1 and J6 and the wire from the top terminal of the Over Pressure Switch to the Frontpanel Power Switch.
(32) Slip Restrictor approximately half way into this piece of Tubing with 1/16" Allen Wrench.
TEE 3
(72) TEE 2
(72) TEE 1
(78)
(51)
(38)
(53)
(67)
1 Left Side Of Tee 1 To Inflate Port-2"
2 Sense Port To Transducer - 5 3/4"
3 Right Side Of Tee 1 To Pump - 3
4 Right Side Of Tee 3 To Manometer-3"
5 Top Of Valve To Bottom Of Tee 2-1"
6 Bottom Of Tee 3 To Over Pressure Switch-4 1/4"
7 Top Of Tee 1 To Left Side Of Tee 2-3 1/2"
8 Right Side Of Tee 2 To Left Side Of Tee 2-2"

LOC	PART NO.	NO. REQ'D	DESCRIPTION	MAT'L. REQ'MT.

TOLERANCES
Unless otherwise specified
X ± .030
XX ± .015
XXX ± .005
FRACTIONS 12 IN OR LESS ± 1/32
GREATER THAN 12 IN ± 1/16
ANGLES 1/2 DEG
FINISHES 125

DRAWN
CHECKED 11/89
DESIGNED 11/89
NEXT ASSEMBLY APPROVED

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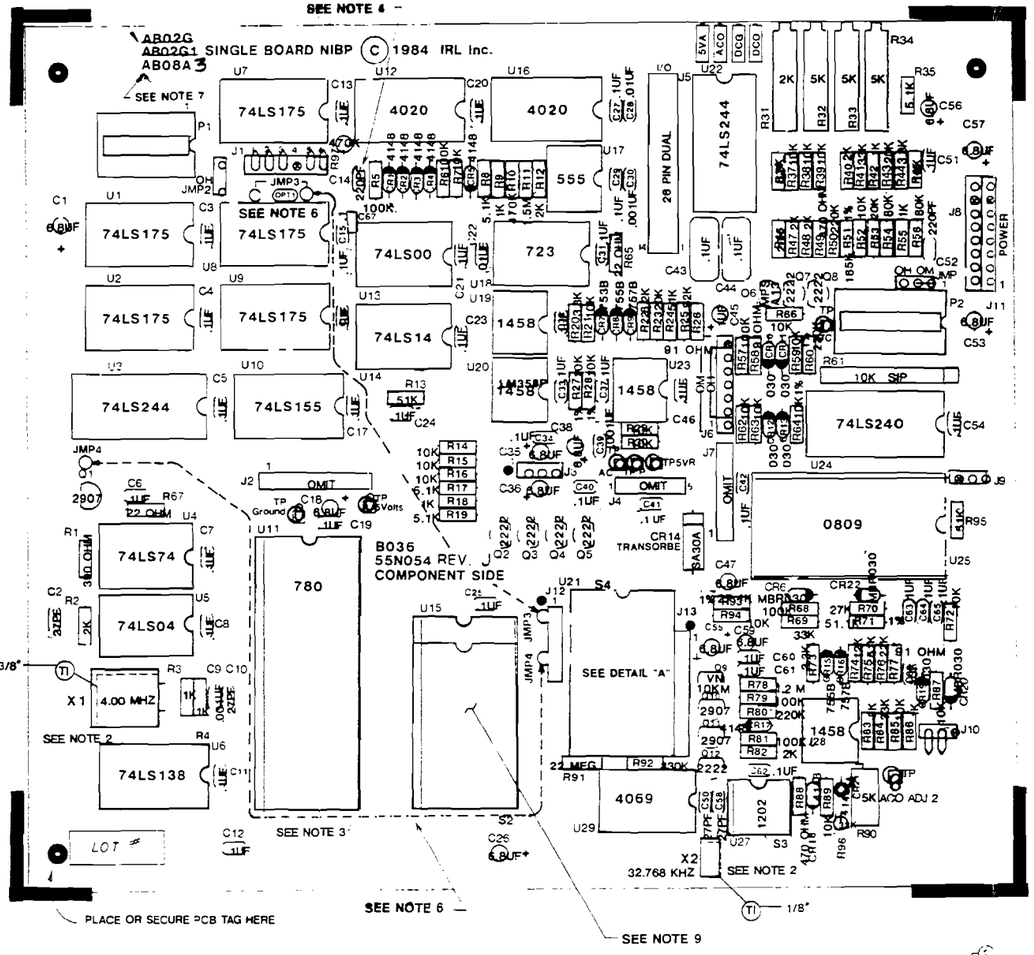
OMEGA 1400 / MRI #AF17

SCALE	SHEET	DWG. NO.	REV
N/A	5 OF 5	97D270	J.

LTR	REVISION	BY	DATE



ASSEMBLY NOTES

1. INVIVO ASSEMBLY NUMBER CROSS OUT NUMBER NOT PERTAINING TO THIS ASSEMBLY
2. PLACE TAPE (ITEM TI) UNDER BOTH CRYSTALS AS SHOWN
3. BEND TEST POINTS ABOVE U11 TOWARDS TOP OF PCB BEND TEST POINTS TO RIGHT OF R90 TOWARDS BOTTOM OF PCB
4. ASSEMBLE C11 FLAT TO THE BOARD.
5. PINS (AS INDICATED BY "X") ARE TO BE CUT AT BOARD ASSEMBLY LEVEL AND INSPECTED AT QC LEVEL TO VERIFY.
6. FOR JUMPERS 3 AND 4 USE BLUE BUSS WIRE AND ROUTE JUMPERS ON COMPONENT SIDE OF PCA ACCORDING TO THE OUTLINES PROVIDED ON THE SILKSCREEN.
7. WITH BLACK INDELIBLE INK, PLACE A "3" AFTER AB08A AS SHOWN.
8. REFERENCE SCHEMATIC DWG. #85D067.
9. SOFTWARE EPROM SHOWN IN LOCATION U15 IS FOR REFERENCE ONLY. ONE OF THESE EPROMS AM07, AM07A, AM07B, AM16, OR AM19, IS TO BE INSTALLED ONTO BOARD AT THE NEXT ASSEMBLY LEVEL.

S4	P000	1	24 PIN ICN34655T
J13	PA177	1	HEADER, SHRD. SR, 9 PIN (.10)
2	WT11	3/4"	HEAT SHRINK , 1/8" I.D. CLEAR
U20	IL22	1	LM358P DUAL OPNL AMPLIFIER
X2	XC03	1	CRYSTAL 32.768 KHZ
X1	XC02	1	CRYSTAL 4.00 MHZ
JMP 1	W019	1"	24 GAGE #299 SOFT DRAWN BUSS
R92	R085	1	RES , 330K .25W 5% CF
R91	R081	1	RES , 22 MEG .25W 5% CF
R70	R059	1	RES , 27K .25W .5% CF
R1	R037	1	RES , 390 OHM .25W , 5% CF
R49,88	R033	2	RES , 470 OHM .25W , 5% CF
R25	R029	1	RES , 82K .125W 1% MF 2
R22	R028	1	RES , 6.2K .25W 5% CF
R50,60	R025	3	RES , 220K .25W 5% CF
R54,56	R024	2	RES , 180K .25W 5% CF
R13 95,75	R023	4	RES ,51K .25W 5% CF
R23 46,53	R022	4	RES , 20K .25W 5% CF
R74	R021	1	RES , 12K .25W 5% CF
R76	R020	1	RES , 22K .25W 5% CF
R20 36 44,73	R018	4	RES , 3.3K .25W 5% CF
R2 82,83 47,48 12,40	R017	7	RES , 2K .125W 5% CF
R78	R013	1	RES , 1.2 MEG .125W 5% CF
R69,84, 41,96	R011	4	RES , 33K .125W 5% CF
R65,67	R009	2	RES , 22 OHM .125W 5% CF
R26 58,77	RC07	3	RES , 91 OHM .125W 5% CF
R11	RC05	1	RES , 1.5 MEG .25W 5% CF
R10,97	R004	2	RES , 470K .125W 5% CF
R8,17 19,35	R003	4	RES., 5.1K .25W 5% CF
R7 87,89 72,85 66,84 62,63 45,52 38,39 30,37 21,29 14-16	R002	20	RES. , 10K .25W 5% CF
R3,4,9 55,86 18,42	R001	7	RES , 1K .25W 5% CF
R5,68 79,81 6,57	R000	6	RES , 100K .125W 5% CF
R61	RS06	1	RES , 10K SIP 10 PSTN CF
R90	RP24		RES. 5K POT 68XR5K
R32-34	RP16	3	RES , 5K POT 89PR5K
R31	RP14	1	RES , 2K POT 89PR2K
R93	RF25	1	RES , 27 . 4K , .125W 1% MF
R51	RF08	1	RES , 165K .125W 1% MF
R27,28 59,64	RF07	4	RES , 10K .125W 1% MF
R71	RF05	1	RES , 51 . 1K . 125W 1% MF
Q9	Q003	1	VN10KM VMOS
C28	CP07	1	.01uF 2% 50V POLYESTER
Q6	Q002	1	MPSA13 NPN MOTOROLLA
TG,11 Q1	Q001	3	MPS2907A PNP
7,9,12 Q2-5	Q000	7	MPS2222A NPN
J12	PA175	1	HEADER, SHRD. SR, 5 PIN (.10)
IS3	P006	1	8 PIN DIP SOCKET
P2	P005	1	16 PIN DIP SOCKET
P1	P004	1	14 PIN R/N ICN14333T
J5	PA02	1	STIX , DUAL 26 PIN
S2	P001	1	28 PIN ICN28634T
J1	PA38		STIX , RIGHT ANGLE 6 PIN 1-87551-6
J8	PA24	1	STIX , 7 PIN , 1/2" 103321-7
J10	PA23	1	STIX RIGHT ANGLE 3 PIN
J9	PA06	2	STIX , 3 PIN 103321-6
J6 J11	PA03	2	STIX , 8 PIN , 1/2",103321-8
J5	PA02	1	STIX , DUAL , 26 PIN 1-87543-3
TP	PA00	7	STIX ,1 PIN , 1/2"
TI	M000	.5"	TAPE , DEDF DF 3/8" X 1/16" 3M 4004
U4	I027	8	74LS74AN DUAL "D" FLIP FLOP
U5	I013	1	74LS04N HEX INVERTER
U13	I010	1	74LS00 QUAD 2 INPUT NAND GATE
U24	I008	1	74LS240N INVERTING BUFFER
U10	I007	1	74LS155N DECODER
U1,2 7-9	I006	5	74LS175M QUAD "D" FLIP FLOP
U3,22	I005	2	SN74LS244N NON INVERTER BUFFER
U14	I003	1	SN74LS14N SCHMITT HEX INVERTER
U6	I001	1	SN7415138 DECODER
U18	IR19	1	MC1723CP VOLTAGE REGULATOR
U11	IN23	1	UPD780C PROCESSOR
U21	IM03	1	HM6116LFP-3 8 BIT STATIC RAM
U19,23, 28	IL18	3	MC1458CP1 DUAL OPNL AMPLIFIER
U17	IL12	1	NE555 TIMER (MC1455)
U27	IC85	1	CLOCK, TIMER, DS1202
U29	IC37	1	HCF4069UBE INVERTER
U25	IC09	1	ADC0809CCN A/D COVERTER
U12,16	IC03	2	MC14020BCP COUNTER
19,20 10-13 CR6,22	D009	8	SCHOTTKY MBR030
21 17,18 CR1-5	D000	8	SIGNAL 1N4148
CR14	DZ20	1	TRANSORBE SA30A
14 C49	DZ06	4	ZENER 1N757B
C48,15	DZ05	2	ZENER 1N755B
CR7	DZ04	1	ZENER 1N753B
C45	CT09	1	1UF 20% 35V TANTALUM
57,59 55-56 47,53 36,38 26,35 C1,18 C43, 44	CT01	12	6.8UF 20% 16V TANTALUM
C67	CC12A	1	.1UF 20% 50V Z5U CER.
60-66 51,54 42 46, 37,40 31-34 27,29 23-25 19-21 15-17 11-13 IC 3 C4-8 41	CC12	38	.1UF 20% 50V Z5U CER.
C35 39 , 6	CC05	3	.001UF 10% 50V X7R CER.
C22	CC04	1	.01UF 10% 50 50V X7R CER.
C14 52	CC02	2	220PF 20% 50V Z5U CER.
C2,10, 30,58	CC00	4	27PF 20% 50V Z5U CER.
1	B036	1	PCB, SNIBP OMEGA 1400 ' 55M054 REV. J

LOC.	PART NO	NO REQ'D	DESCRIPTION	MAT'L REQ'MT

LTR	REVISION	BY	DATE
B	PER ECN NO. 2955M		
A	PER ECN #2812		4/91

TOLERANCES
Unless otherwise specified
X ± .030
.XX ± .015
.XXX ± .005
FRACTIONS 1/2 IN OR LESS ± 1/32
GREATER THAN 12 IN ± 1/16
ANGLES 1/2 DEG
FINISHES 125

DRAWN
CHECKED
DESIGNED
NEXT ASSEMBLY
APPROVED

Invivo Research Laboratories Inc

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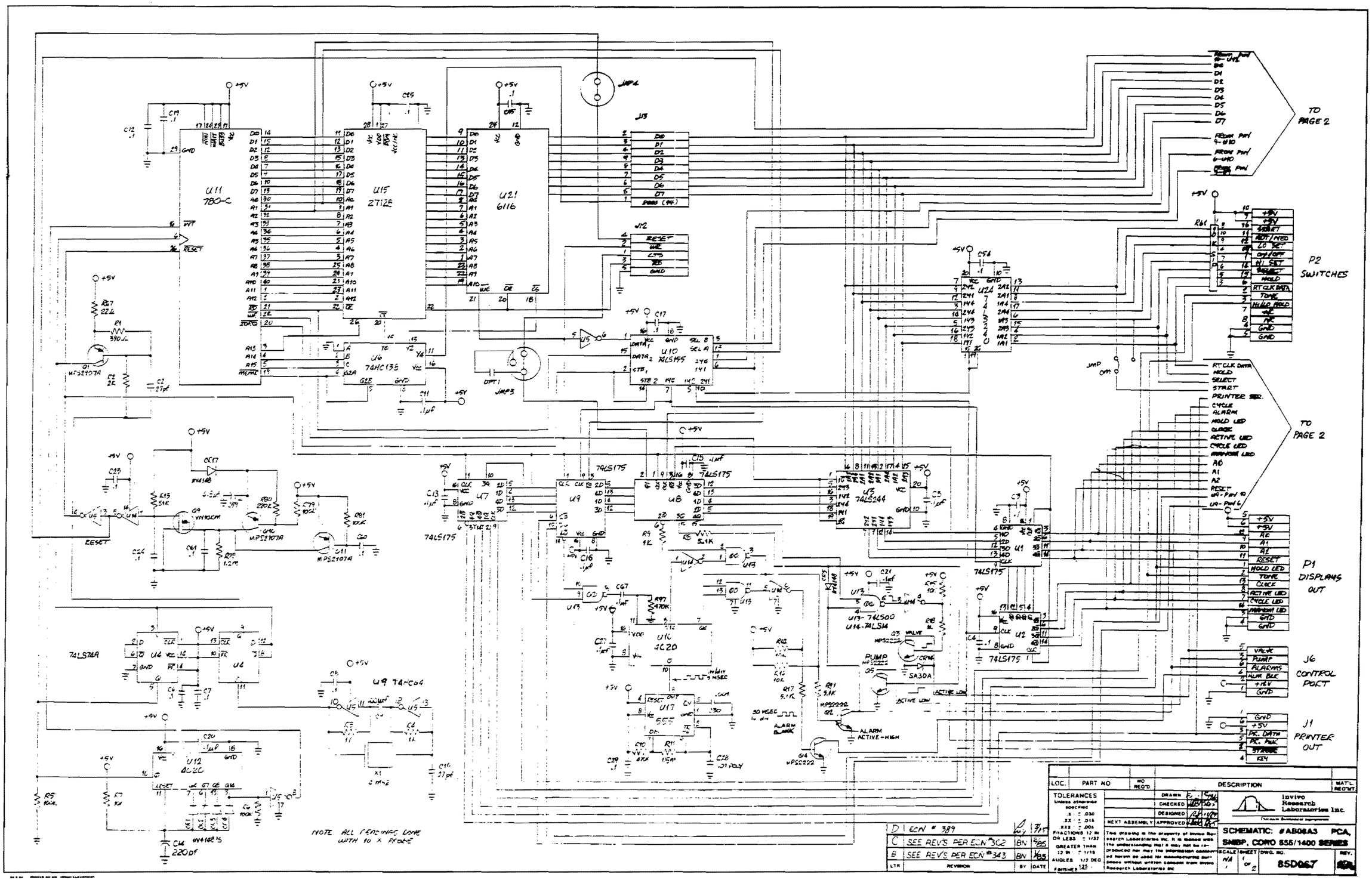
ASSEMBLY: #AB08A3 PCA, SNIBP, CORO 555/1400 SERIES

SCALE NONE | SHEET 1 OF 1 | DWG. NO. 194D502 | REV. B


U11 780-C
U15 27128
U21 6116
U6 74HC138
U10 74LS155
U4 74HC04
U9 74HC04
U12 4020
U16 4020
U17 555
U24
U13 74LS00
U16 74LS14
U3 74LS244
U7 74LS175
U8 74LS175
U9 74LS175
U1 74LS175
U2 74LS175
U5 74LS74A
U14 74LS04
U15 74LS04
U4 74LS04
U11 MPS2907A
U12 MPS2907A
Q1 MPS2907A
Q2 MPS2222
Q3 MPS2222
Q4 MPS2222
Q5 MPS2222
Q6 MPS2222
D1 1N4148
D2 1N4148
D3 1N4148
D4 1N4148
D5 1N4148
D6 1N4148
D7 1N4148
D8 1N4148
D9 1N4148
D10 1N4148
D11 1N4148
D12 1N4148
D13 1N4148
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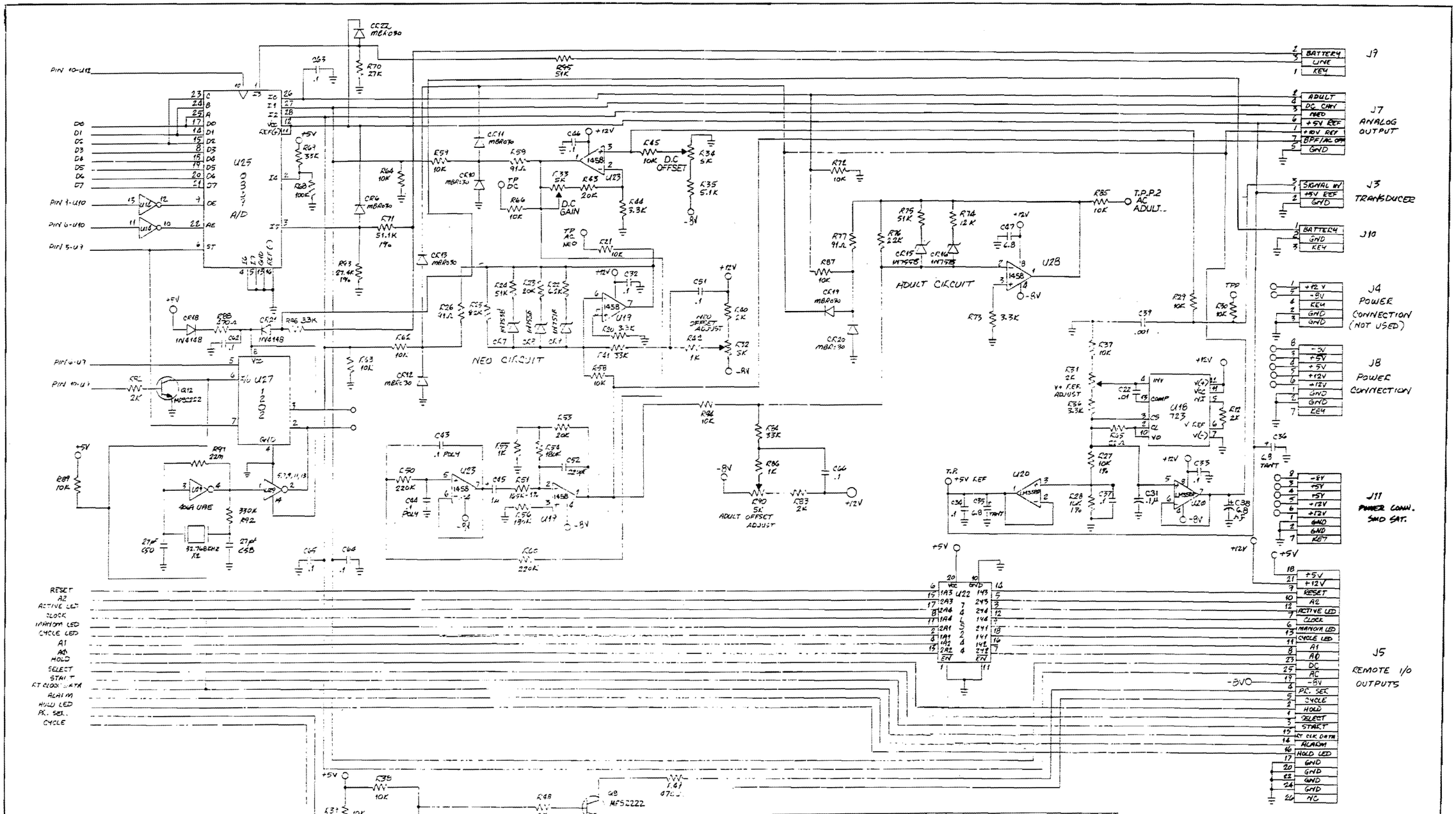
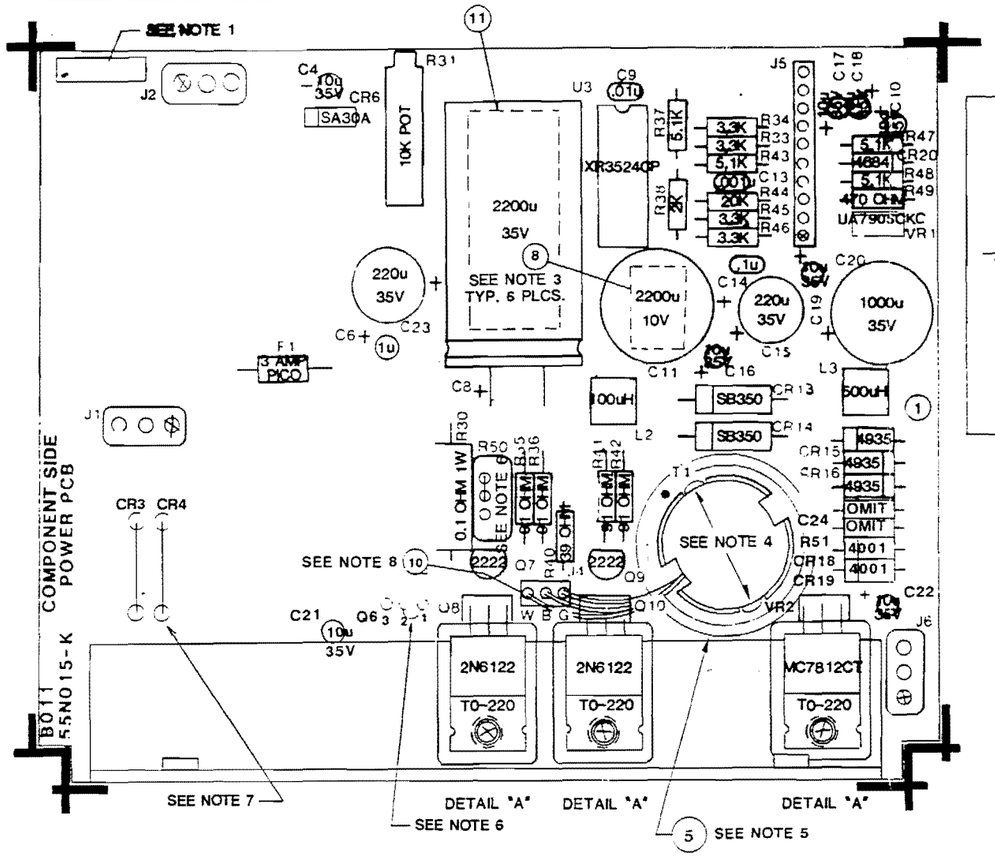
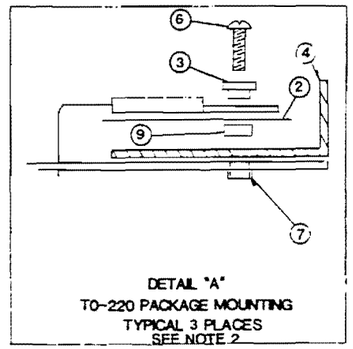
D19 1N4148
D20 1N4148


J9
BATTERY
LINE
KEY
J7
ANALOG OUTPUT
ADULT
DC CAN
NEO
+5V REF
+10V REF
BPF/HC OP
GND
J3
TRANSDUCER
SIGNAL W
+5V REF
GND
J10
BATTERY
GND
KEY
J4
POWER CONNECTION (NOT USED)
+12 V
-8V
KEY
GND
GND
J8
POWER CONNECTION
-8V
+5V
+5V
+12V
+12V
GND
GND
KEY
J11
POWER CONN. SMD SAT.
-8V
+5V
+5V
+12V
+12V
GND
GND
KEY
J5
REMOTE I/O OUTPUTS
+5V
+12V
RESET
A2
ACTIVE LED
CLOCK
MANOM LED
CYCLE LED
A1
A0
DC
AC
-8V
PC. SEL
CYCLE
HOLD
SELECT
START
RT CLK DATA
ALARM
HOLD LED
GND
GND
GND
GND
NC
U25 A/D
U27 I/O
U19 1458
U23 1458
U28 1458
U20 LM358
U18 723
NEO CIRCUIT
ADULT CIRCUIT
D.C OFFSET
D.C GAIN
NEO OFFSET ADJUST
ADULT OFFSET ADJUST
V+ REF. ADJUST
V REF
T.P.P.2 AC ADULT
TPP
TP DC
TP AC NEO
+5V REF
Q12 MPSC252
Q7 MPS2222
Q8 MPS2222
MPSA13
40MHz UBE
32.768KHz XL
1N6148
MBR030
MYS56
MYS57
MYS58
CR22 MBR030
CR11 MBR030
CR10 MBR030
CR6 MBR030
CR13 MBR030
CR12 MBR030
CR18
CR19 MBR030
CR20 MBR030
CR15 MYS58
CR16 MYS58
R70 27K
R67 33K
R68 100K
R69 10K
R71 51.1K 1%
R73 3.3K
R74 12K
R75 51K
R76 22K
R77 91Ω
R78 10K
R79 10K
R80 2K
R81 1K
R82 33K
R83 2K
R84 10K
R85 10K
R86 1K
R87 10K
R88 10K
R89 10K
R90 5K ADULT OFFSET ADJUST
R91 22M
R92 330K
R93 27.4K 1%
R94 10K
R95 51K
R96 33K
R97 10K
R98 2K
R99 1K
R100 10K
R101 33K
R102 10K
R103 10K
R104 2K
R105 100K
R106 220K
R107 220K
R108 10K
R109 10K
R110 10K
R111 10K
R112 10K
R113 10K
R114 10K
R115 10K
R116 10K
R117 10K
R118 10K
R119 10K
R120 10K
R121 10K
R122 10K
R123 10K
R124 10K
R125 10K
R126 10K
R127 10K
R128 10K
R129 10K
R130 10K
R131 2K V+ REF. ADJUST
R132 2K
R133 3.3K
R134 3.3K
R135 3.3K
R136 3.3K
R137 3.3K
R138 3.3K
R139 3.3K
R140 5K ADULT OFFSET ADJUST
R141 3.3K
R142 2K
R143 2K
R144 2K
R145 10K D.C OFFSET
R146 2K
R147 2K
R148 2K
R149 1K
R150 1K
R151 1K
R152 1K
R153 1K
R154 1K
R155 1K
R156 1K
R157 1K
R158 1K
R159 1K
R160 1K
R161 1K
R162 1K
R163 1K
R164 1K
R165 1K
R166 1K
R167 1K
R168 1K





DETAIL "A"
TO-220 PACKAGE MOUNTING
TYPICAL 3 PLACES
SEE NOTE 2

LAST DESIGNATORS

R50 (ON SILKSCREEN, WITH 26 AND 32 NOT USED)
[R1-29, 50 NOT USED ON THIS ASSEMBLY]

C23 (ON SILKSCREEN)
[C1-3, 5, 7 NOT USED ON THIS ASSEMBLY]

CR20 (ON SILKSCREEN)
[CR1-5, 7-12 NOT USED ON THIS ASSEMBLY]

U3 (ON SILKSCREEN)
[U1, 2 NOT USED ON THIS ASSEMBLY]

J6 (ON SILKSCREEN)
[J2 NOT USED ON THIS ASSEMBLY]

Q10 (ON SILKSCREEN)
[Q1-6 NOT USED ON THIS ASSEMBLY]

L3 (ON SILKSCREEN)
[L1 NOT USED ON THIS ASSEMBLY]

VR2

T1

F1

ASSEMBLY NOTES:
1. AREA DESIGNATED FOR LOT NUMBER.
2. SECURE ALL HARDWARE WITH BLUE LOC-TITE.
3. PLACE M004, (8) DOUBLE BACKED TAPE, UNDER C11, C14, C20, C23, L2 & L3 BEFORE FLOW SOLDERING.
4. BEFORE INSTALLING T1, TAK-PAK (USE ACCELERATOR ALSO) BASE TO BOBBIN ON BOTH SIDES.
5. ATTACH TO BOARD USING RTV AFTER INSTALLING TRANSFORMER.
6. INSTALL JUMPER AS SHOWN AT Q6 BETWEEN PINS 1 AND 2.
7. INSTALL JUMPERS AT CR3 AND CR4 LOCATIONS AS SHOWN.
8. PLACE HI23, GLASS BEAD, (10) ON WIRES (3 PLCS) TO SPACE OFF BOARD & KEEP SHELLAC OUT OF SOLDER JOINT.

LTR	REVISION	BY	DATE
E	PER ECN #3008		8/11
D	PER ECN #2099 M	CHIY	11/3/1
C	PER ECN #2024		8/100
B	PER ECN #1473		11/3
A	PER ECN 1305 M	JNEL	6/88

LOC.	PART NO.	NO. REQ'D.	DESCRIPTION	MAT'L. REQ'MT.
R35 36 47 48 R37 43	R007	4	RES, 91 OHM .25W 5% CF	
	R003	4	RES, 5.1K .25W 5% CF	
R30	R055	1	RES, 0.1 OHM 1W 5% MO	
R40	R052	1	RES, 39 OHM .25W 5% CF	
R31	RP58	1	RES, 10K POT 89PR10K	
R49	R033	1	RES, 470 OHM .25W 5% CF	
Q8 10	Q007	2	2N6122 NPN	
R44	R022	1	RES, 20K .25W 5% CF	
Q7 9	Q000	2	MPS2222A NPN	
J5	PA33	1	STIX, 10 PIN 1/2" 1-103321-0	
J1 2 6	PA29	3	STIX, 3 PIN (.156) 85830-3	
10	HI23	3	INSULATOR, GLASS BEAD	
9	NW16	3	WASHER, NYLON #4 X .250 O.D. X .062	
8	M004	2 1/4"	TAPE, DS 1/2" X .010	
7	NC03	3	NUT, CAPTIVE #4-40 KF2-440	
6	NS04	3	#4-40X 1/4" PH PNH PLD ZINC	
5	H067	1	SHIELD, TRANSFORMER, MRI/1400	
VR2	IR44	1	MC7812CT POSITIVE REGULATOR	
VR1	IR48	1	UA7905CKC NEGATIVE REGULATOR	
U3	IR36	1	XR3524CP VOLTAGE REGULATOR	
R38	R017	1	RES, 2K .25W 5% CF	
4	HQ01	1	HEAT SINK #AB08F	
3	HI03	3	BUSHING, NYLON B51547F015	
2	HI01	3	INSULATOR, THERMOLLOY # 54-77-2	
F1	FU08	1	3 AMP PICO FUSE 255003	
CR13 14	D021	2	SCHOTTKY SB350	
Q6 CR3 CR4	W019	3"	24 GAGE #299 SOFT DRAWN BUSS	
CR15-17	D015	3	RECTIFIER 1N4935 200V	
11	M000	1.25"	TAPE, DF 3/8" X 1/16" 4004	
CR18 19	D001	2	POWER 1N4001	
R45 46 R33 34	R018	4	RES. 3.3K .25W 5% CF	
CR6	DZ20	1	TRANSORBE SA30A	
T1	T001	1	TRANSFORMER, SWITCHING POT-CORE	
CR20	DZ10	1	ZENER 1N4684 3.3V	
L2	T003	1	COIL, 100uH 10% E4082-A	
L3	T004	1	COIL, 500uH 10% E4083-A	
21 22 16-19 10 C4	CT13	8	10uF 20% 35V TANT	
C6	CT09	1	1uF 20% 35V TANT	
C14	CC12	1	.1uF 20% 50V Z5U CER .25" AXIAL	
C13	CC05	1	.001uF 10% 50V X7R CER	
C9	CC04	1	.01uF 10% 50V X7R CER	
C8	CA18	1	2200uF 10%/50% 35V AL	
C20	CA17	1	1000uF 10%/50% 35V AL	
C11	CA16	1	2200uF 10%/50% 10V AL	
C15 23	CA15	2	220uF 10%/50% 35V AL	
1	B011	1	POWER PCB 55N015 REV. K	

TOLERANCES
Unless otherwise specified
.X = ± .030
.XX = ± .010
.XXX = ± .005
FRACTIONS 12 IN OR LESS = ± 1/32
GREATER THAN 12 IN = ± 1/16
ANGLES = 1/2 DEG
FINISHES 125

DRAWN 3/87
CHECKED
DESIGNED 3/87
NEXT ASSEMBLY APPROVED 5/87

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Invivo Research Laboratories Inc.
Precision Biomedical Instruments

#AB08F2 - POWER BD. ASSEMBLY, 1400, OMNI MRI NIBP OPTION

SCALE	SHEET	DWG. NO.	REV.
2/1	1 OF 1	94C397	E

18574 PRINTED ON NO 1 BOOK CLEARPRINT

LAST DESIGNATORS

R50 (ON SILKSCREEN, WITH 26 AND 32 NOT USED)
[R1-29, 50 NOT USED ON THIS ASSEMBLY]

C23 (ON SILKSCREEN)
[C1-3, 5, 7 NOT USED ON THIS ASSEMBLY]

CR20 (ON SILKSCREEN)
[CR1-5, 7-12 NOT USED ON THIS ASSEMBLY]

U3 (ON SILKSCREEN)
[U1, 2 NOT USED ON THIS ASSEMBLY]

J6 (ON SILKSCREEN)
[J2 NOT USED ON THIS ASSEMBLY]

Q10 (ON SILKSCREEN)
[Q1-6 NOT USED ON THIS ASSEMBLY]

L3 (ON SILKSCREEN)
[L1 NOT USED ON THIS ASSEMBLY]

VR2

T1

F1

J1 POWER SWITCH — POWER IN, POWER OUT, KEY

F1 3 AMP PICO FUSE

JMP Q6

C6 1U

C21 10U

C23 220U

J6 PUMP — KEY, + VOLTS, GND

C10 10U

R33 3.3K

R34 3.3K

R35 91 OHM

Q7 MPS2222

R45 3.3K

Q8 2N6122

R36 91 OHM

R42 91 OHM

R46 3.3K

Q10 2N6122

Q9 MPS2222

R41 91 OHM

U3 SG3524 — V IN, V REF, NI, INV, RT, CT, E6, CL-, SHUTOFF, GND, CL+, COMP

R43 5.1K

R37 5.1K

R31 10K POT

R38 2K

C9 .01U

C13 1000PF

R44 20K

R40 39 OHM

R30 .1 OHM 1W

(J4) BLACK

(J4) WHITE

(J4) GRAY

T1

C11 2200U

C16 10U

L2 100uH

C17 10U

R47 5.1K

CR13 SB340

SB340 CR14

CR16 1N4935

1N4935 CR17

CR15 1N4935

CR19 1N4001

CR18 1N4001

L3 500uH

VR2 LM7812

C20 1000U

C22 10U

C15 220U

UA7905 VR1

C19 10U

R49 470 OHM

C14 .1U

1N4864 CR20

C18 10U

R48 5.1K

J5 POWER OUT — KEY, +5V, +5V, +12V, +12V, -8V, LINE, BATTERY, GND, GND

JMP CR3

JMP CR4

C8 2200U

C4 10U

CR06 SA30A

J2 VOLTAGE IN — +V, -V(GND), KEY

REV.	DESCRIPTION	BY	DATE
B	PER ECN NO. 2995		
A	PER ECN# 1305M		

LOCATION	PART NO.	QTY.	DESCRIPTION
UNLESS SPECIFIED TOLERANCES ARE	DRAWN		
	DESIGNED		
	CHECKED		
	APPROVED		

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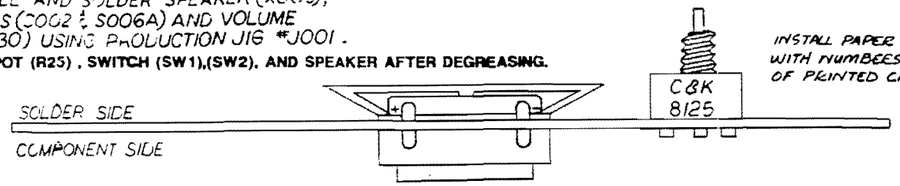
INVIVO RESEARCH INC.
3061 WEST ALBANY
BROKEN ARROW, OKLAHOMA 74012

TITLE: # AB08F2 - POWER BD. SCHEMATIC, 1400, OMNI MRI NIBP OPTION

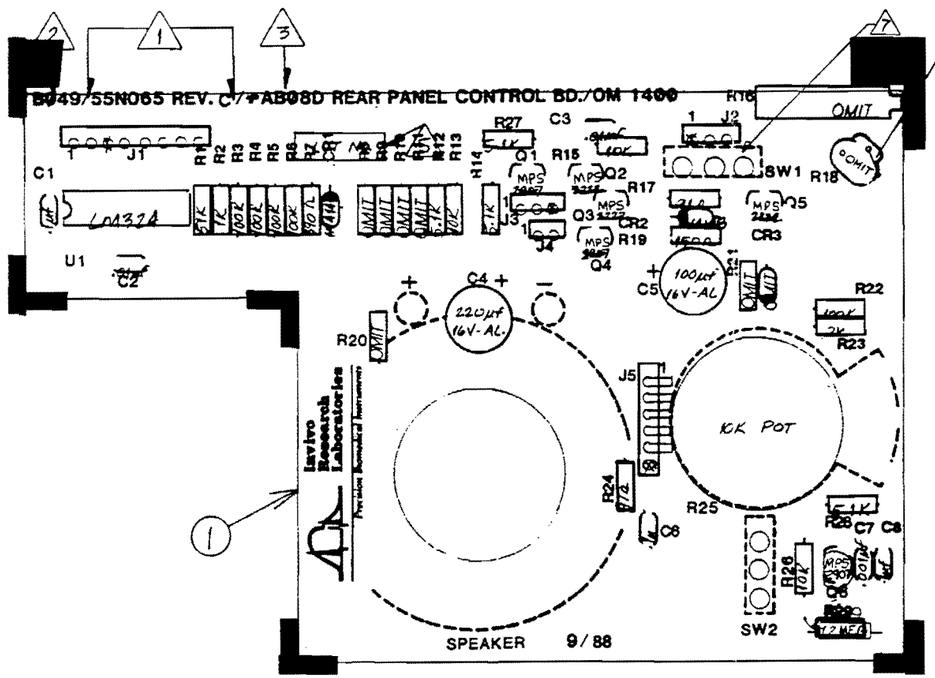
SCALE	SHEET	DWG. NO.	REV.
N/A	1 1	85C127	B

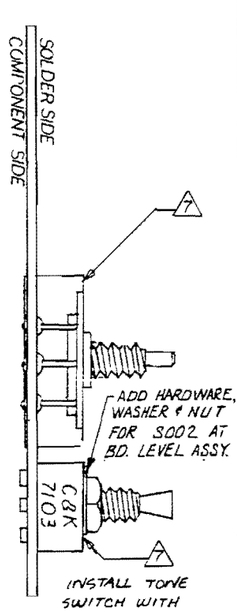
ASSEMBLE AND SOLDER SPEAKER (X005), SWITCHES (S002 & S006A) AND VOLUME POT (RP30) USING PRODUCTION JIG #J001.

INSTALL POT (R25), SWITCH (SW1),(SW2), AND SPEAKER AFTER DEGREASING.



INSTALL PAPER FEED SWITCH WITH NUMBERS FACING TOP OF PRINTED CIRCUIT BOARD





INSTALL TONE SWITCH WITH NUMBERS FACING RIGHT SIDE OF PRINTED CIRCUIT BD

W	PER ECN #2023		8/89
U	PER ECN #1916		7/88
T	PER ECN 1833		5/87
S	PER ECN 1726		9/86
R	PER ECN 1658		3/1/86
P	PER ECN 1582		1/29/86
N	PER ECN #1430	SR	9/88
M	PER ECN 1362		7/88
L	PER ECN * 1275		4/88
K	PER ECN * 1211M		3/88
J	" " " " #990M		7/87
H	" " " " #872		5/87
G	" " " " #802	GA	12/86
F	" " " " #741		7/86
E	" " " " #726	GA	7/86
D	" " " " #529	GA	8/85
C	" " " " #506	GA	8/85
B	SEE REV'S PER ECN #304	BN	1/85
A	SEE REV'S PER ECN #275	BN	11/84
LTR	REVISION	BY	DATE

LOC.	PART NO.	NO. REQ'D.	DESCRIPTION	MAT'L. REQ'MT.
R29	R013	1	RES. 1.2MEG, .25W, 5% CF	
R23	R017	1	RES, 2K .25W 5% CF	
R2	R001	1	RES, 1K .25W 5% CF	
R1	R023	1	RES, 51K .25W 5% CF	
R25	RP30	1	RES, 10K POT CM44679	
R3,4,5,6,22	R000	5	RES, 100K .25W 5% CF	
R7	R037	1	RES, 390 OHM .25W 5% CF	
R19	R048	1	RES, 150 OHM .25W 5% CF	
3	W019	A/R	BUSS # 24 GA, SOFT DRAWN	
R17, 24	R007	2	RES, 71 OHM .25W 5% CF	
R13 15, 26	R002	3	RES, 10K .25W 5% CF	
R12,14 27,28	R005	4	RES, 5.1K .25W 5% CF	
Q1,4 6	Q001	3	MPS2907A PNP	
Q2,3 5	Q000	3	MPS2222A NPN	
CR1, 2	D000	2	IN4148 SIGNAL	
C7	C005	1	.001 µf 10% 50V X7R CERAMIC	
C5	CA06	1	100 µf -10% +50% 16V ALUMINUM	
C4	CA07	1	220 µf -10% + 50% 16V ALUMINUM	
C2,3	CC04	2	.01 µf 10% 50V X7R CERAMIC .25"	
C1, 6 8	CC12	3	.1uf 20% 50V Z5U CERAMIC	
J5	PA38	1	STIX, 6 PIN, 1/2" RIGHT ANGLE	
J4	PA47	1	STIX, 2 PIN, 1/2"	
J2,3	PA08	2	STIX, 3 PIN, 1/2"	
J1	PA05	1	STIX, 8 PIN, 1/2"	
U1	IL35	1	LM324 QUAD OPNL AMPLIFIER	
SW2	S002	1	SWITCH, TONE 7103P442Q	
SW1	S006A	1	SWITCH, MOM PB 81258/8025	
2	X005	1	SPEAKER, 2/10 WATT 50RF3A	
1	B049	1	REAR PANEL PCB, OM 1400/55N065 REV. C	

TOLERANCES Unless otherwise specified
.X = ± .030
.XX = ± .010
.XXX = ± .005
FRACTIONS 12 IN OR LESS = ± 1/32
GREATER THAN 12 IN = ± 1/16
ANGLES = 1/2 DEG
FINISHES 125

DRAWN	CS	10/5/88
CHECKED	JN	10/5/88
DESIGNED	CS	10/5/88
NEXT ASSEMBLY	APPROVED	

Invivo Research Laboratories Inc.
Precision Biomedical Instruments

PCA, REAR PANEL CONTROL OMEGA 1400 #AB08D

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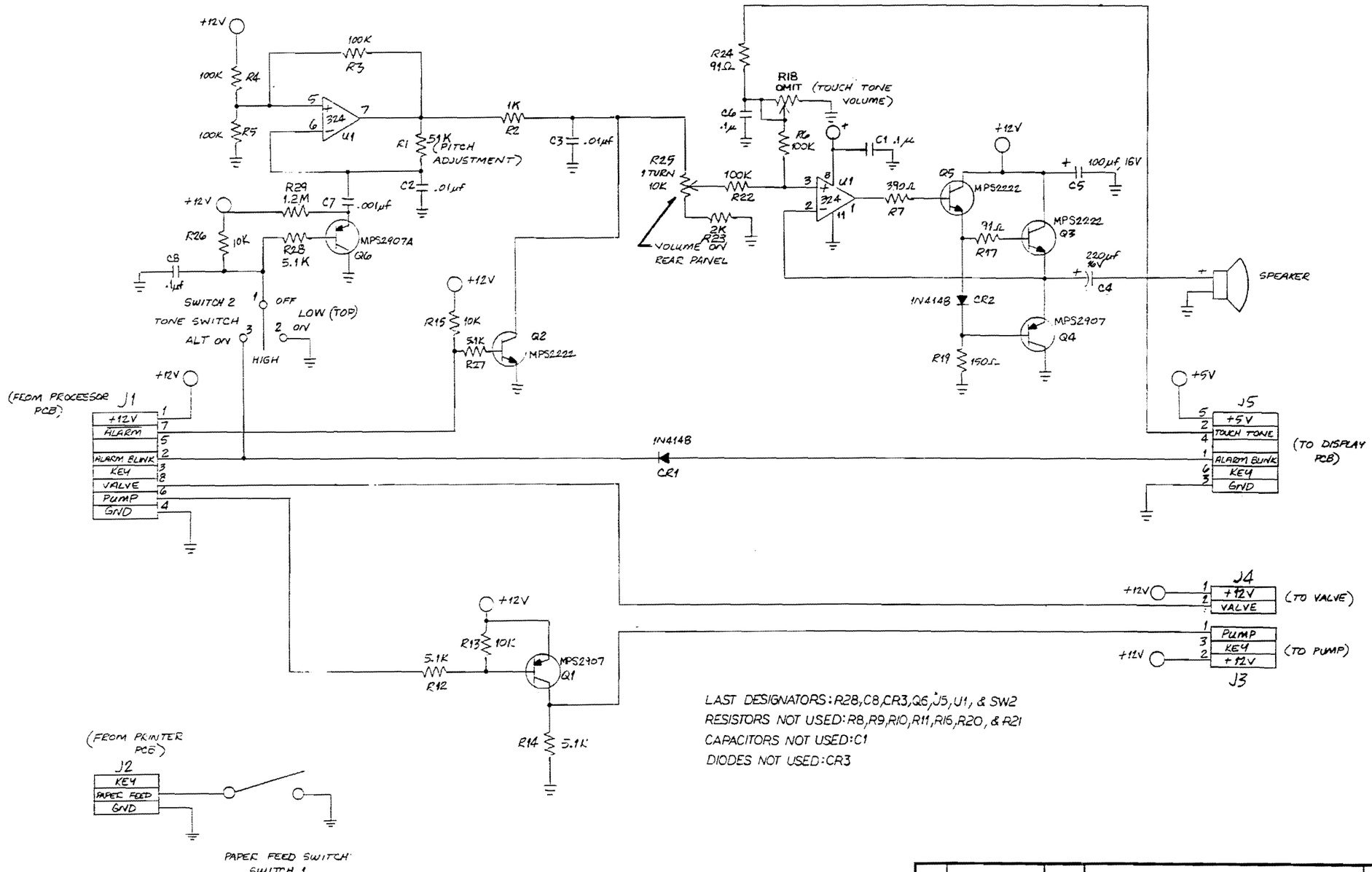
SCALE 2/1 | SHEET 1 OF 1 | DWG. NO. 94C214 | REV. W

NOTES:

1. REVISION LEVEL ARTWORK IDENTIFICATION NUMBER.
2. INVIVO PART NUMBER FOR PCB
3. INVIVO ASSEMBLY NUMBER
4. DASHED LINES INDICATE PARTS MOUNTED ON SOLDER SIDE. FOR PARTS MOUNTED ON SOLDER SIDE, MASK ALL HOLES WHERE THEY ARE TO BE PLACED BEFORE BOARDS GO TO FLOW SOLDER. AFTER FLOW SOLDER, ROUTE BACK TO PCB LINE FOR INSTALLATION AND HAND SOLDERING OF THESE PARTS.
5. AREA DESIGNATED FOR LOT NUMBER
6. PINS INDICATED BY "X" ON CONNECTORS J1, J2, J3 & J5 ARE TO BE CUT AT BOARD ASSY. AND INSPECTED AT QC LEVEL.
7. R 25, SW1 & SW2 SHALL BE INSTALLED SO THAT THE MOUNTING SURFACE OF EACH PART IS THE SAME (EQUAL) DISTANCE FROM PCB SURFACE.



LAST DESIGNATORS: R28, C8, CR3, Q6, J5, U1, & SW2
RESISTORS NOT USED: R8, R9, R10, R11, R16, R20, & R21
CAPACITORS NOT USED: C1
DIODES NOT USED: CR3

LTR	REVISION	BY	DATE
E	" " " #1275	ED	8/88
D	" " " #726	GA	7/86
C	" " " #469	GA.	6/85
B	REV'S PER ECN #326	BN	1/85
A	REV'S PER ECN # 304	BN	1/85

LOC.	PART NO.	NO. REQ'D.	DESCRIPTION	MAT'L REQ'MT.

TOLERANCES
Unless otherwise specified
.X = ± .030
.XX = ± .015
.XXX = ± .005
FRACTIONS 12 IN OR LESS = ± 1/32
GREATER THAN 12 IN = ± 1/16
ANGLES = 1/2 DEG
FINISHES 125

NEXT ASSEMBLY

DRAWN	LS	1/88
CHECKED	JW	10/88
DESIGNED		
APPROVED	[illegible]	1/89

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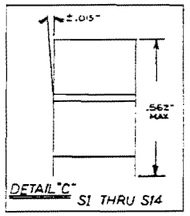
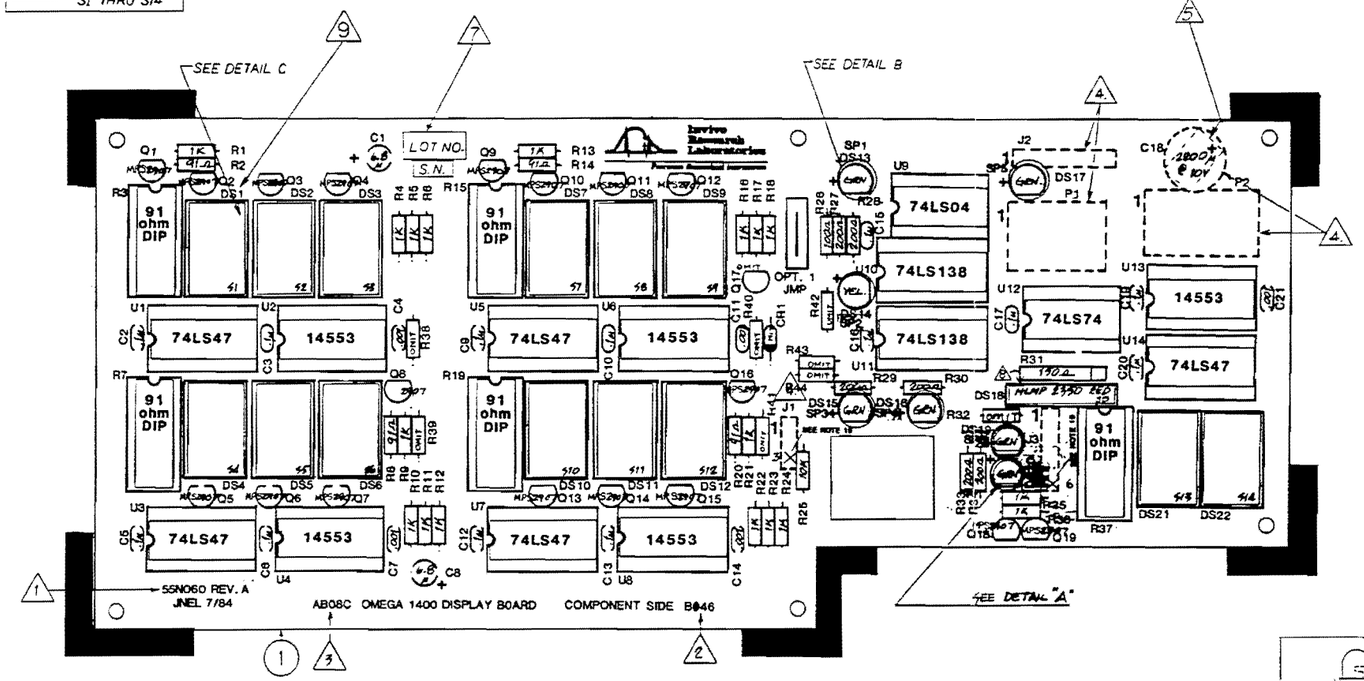
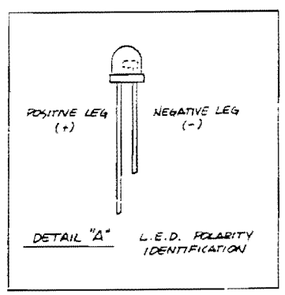
Invivo Research Laboratories Inc.
Precision Biomedical Instruments

SCHEMATIC: REAR PANEL CONTROL BOARD, OMEGA 1400 #AB08D

SCALE	SHEET	DWG. NO.	REV.
NA	1 OF 1	85C064	E

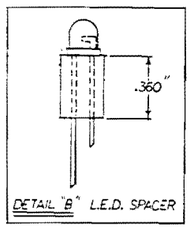






NOTES.

1. REVISION LEVEL ARTWORK IDENTIFICATION NUMBER.
2. INVIVO PART NUMBER FOR PCB
3. INVIVO ASSEMBLY NUMBER
4. DASHED LINES DENOTE PARTS PLACED ON SOLDER SIDE. ROUTE BOARD BACK TO PCB ASSEMBLY AFTER FLOW SOLDER FOR INSERTION AND HAND SOLDERING OF THESE PARTS.
5. USE TAPE (n004) UNDER C18 TO SECURE CAP TO BOARD.
6. OMIT R32
7. AREA DESIGNATED FOR LOT NUMBER, WHICH SHOULD BE AT LEAST 1/8" FROM EDGE OF BOARD. SERIAL NUMBER IS BELOW LOT NUMBER
8. DS18 SHOULD BE INSTALLED WITH NUMBERS FACING UP.
9. DS1 THRU DS12, DS21 & DS22 ARE TO BE PUT ON BOARD AFTER DEGREASING AND ARE TO BE REMOVED WHILE CLEANING AFTER REWORK.
10. PINS (AS INDICATED BY "X") ON CONNECTORS J3 AND J1 ARE TO BE CUT AT BOARD ASSEMBLY LEVEL AND VERIFIED AT QC INSPECTION LEVEL.



LOC.	PART NO.	NO. REQ'D	DESCRIPTION	MAT'L REQ'MT
S15	P021A	1	8 PIN WW SINGLE ROW SSA/OBWT	
SP1-7	HS25	7	SPACER .360" X #4 CL. 908-360	
J3	PA01	1	STIX, 6 PIN, 1/2"	
P2	PA05	1	16 PIN DIP SOCKET	
P1	PA04	1	16 PIN R/A ICN 163137	
J2	PA24	1	STIX 7 PIN 3/4"	
J1	PA08	1	STIX 3 PIN 1/2"	
DS1/2	DD01	2	DISPLAY, 7 SEGMENT, .5"	
DS10	DL09	1	BAR LED, RED, MLMP 8450 "D"	
DS18	DL18A	1	LED AMBER 5082-4405DA	
DS3 15 16,17 19,20	DL17A	6	LED GREEN 5082-4420DA	
DS11-12	DD02	12	DISPLAY, 7 SEGMENT, MAN 4710	
S1-14	P011	14	16 PIN WW 3L ICN 163W3T	
U2	IC07	1	SN74LS74AN DUAL 'D' FLIP FLOP	
U10 11	IC01	2	SN74LS138 DECODER	
U9	IC11	1	SN74LS04N HEX INVERTER	
U3 4,6 8,13	IC14	5	MC14553B BCD COUNTER	
U1 5,5 7,16	IC15	5	SN74LS47N BCD 7 SEGMENT DCDR	
C18	CA16	1	2200 MF -10%+50% 10V ALUMINUM	
C4 7,11 16,21	CC05	5	.001 MF 10% 50V X7R CERAMIC	
C2 3,5 6,9 10,12 13,15 16,17 19,20	CC12	13	.1 MF 20% 50V Z5U CERAMIC	
C1, 8	CT01	2	6.8 MF, 20% 16V TANTALUM	
RS1	RS38	1	RES. 150Ω SIP 6 PSTN CF	
R27,28 29,30 33,34	RD08	6	RES. 200Ω .25W, 5% CF	
R26	RD06	1	RES. 100Ω .25W, 5% CF	
R25	RD02	1	RES. 10K .25W, 5% CF	
R3, 7 15, 19, 37	RD40	5	RES. 91Ω DIP 8 PSTN CF	
R2, 8, 14, 26	RD07	4	RES. 91Ω .25W, 5% CF	
R1,4,5 9,10 11,12 16,17 18,22 23,24 30,35,	RD01	18	RES. 1K. .25W, 5% CF	
Q1-8, 18, 19	QD01	18	MPS8907 DIP	
①	B046	1	DISPLAY, OMEGA 1400 55N060 REV A	

LTR	REVISION	BY	DATE
P	PER ECN #2255	MH	3/90
N	PER ECN #1660	DEW	1/89
M	PER ECN #1474M	SR	1/88
L	" " #1108	SD	4/87
K	" " #1049	SD	1/87
J	" " #1003	SD	9/86
H	" " #809	GA	1/87
G	" " #729	GA	8/86
F	" " #726	GA	7/86
E	" " #493	GA	7/85
D	" " #441	GA	5-86
C	" " #336	JN	1/85
B	" " #277	BN	7/84
A	SEE REV'S PER ECN #232	BN	1/84

TOLERANCES Unless otherwise specified .X = ± .030 .XX = ± .015 .XXX = ± .005 FRACTIONS 12 IN OR LESS = ± 1/32 GREATER THAN 12 IN: = 1/16 ANGLES = 1/2 DEG FINISHES 125

DRAWN JM 11/84 CHECKED DEW 3/90 DESIGNED JM 11/84 NEXT ASSEMBLY APPROVED DEW 3/90

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Invivo Research Laboratories Inc.
Precision Biomedical Instruments

PCA, DISPLAY
OMEGA 1400 #A808C

SCALE 2/1 | SHEET 1 OF 1 | DWG. NO. 94D170 | REV. P

I.C. CHART							
DEVS.	I.C.	Vcc	GND	DEVS.	I.C.	Vcc	GND
U1, 3, 5, 7, 14	74LS47	16	8				
U2, 4, 6, 8, 13	14553	16	8				
U9	74LS04	14	7				
U10, 11	74LS198	16	8				
U12	74LS74	14	7				

NOTE: ALL TRANSISTORS EXCEPT Q17 ARE MPS2907A'S
Q17 IS A MPS2222.

LTR	REVISION	BY	DATE
E	" " #1049	SD	11/87
D	" " #949	GA	7/87
C	" " #726	GA	7/86
B	" " #678	GA	5/86
A	REVS PER ECN #288	BN	12/84

LOC.	PART NO.	NO. REQ'D.	DESCRIPTION	MAT'L RECVT.

TOLERANCES Unless otherwise specified: X = ± .030, XX = ± .015, XXX = ± .005, FRACTIONS 12 IN OR LESS = ± 1/32, GREATER THAN 12 IN = ± 1/16, ANGLES = 1/2 DEG, FINISHES 125

DRAWN 1/4 7/86 | CHECKED 1/4 7/86 | DESIGNED 1/4 11/15 | APPROVED 1/4 1/6

NEXT ASSEMBLY

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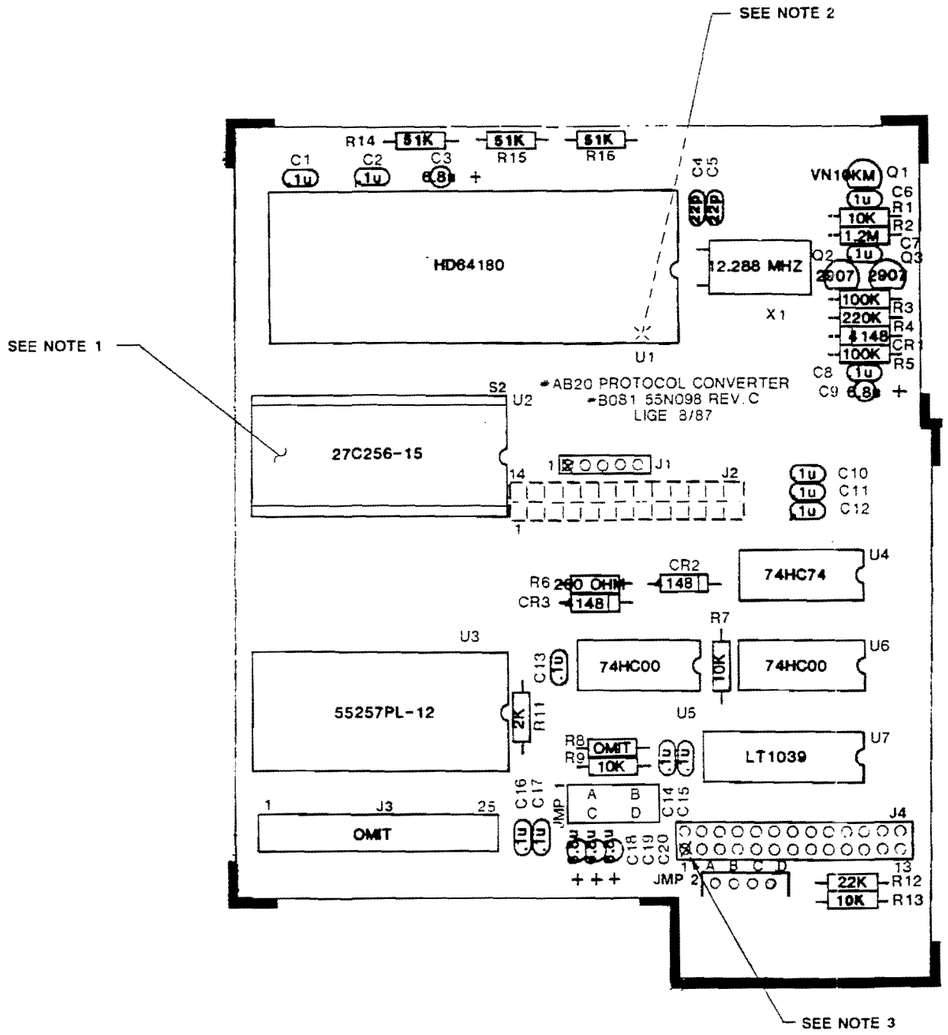
Invivo Research Laboratories Inc.

SCHEMATIC : A80B.C
CARTRIDGE 1400 DISPLAY BD.

SCALE | SHEET 1 OF 1 | DWG. NO. 85 D0668 | REV. E



LAST DESIGNATORS

J4
CR3
R16 (R10 NOT USED)
U7
JMP 2
X1
Q3
C20

NOTES

1. SOFTWARE EPROM SHOWN IN LOCATION U2 IS FOR REFERENCE ONLY. EPROM P/N AM13A IS TO BE INSTALLED ON THE PCA AT THE NEXT ASSEMBLY LEVEL.
2. ON SOLDER SIDE, CUT TRACE AT U1, PIN 64.
3. CUT PIN 1 ON J4

LOCATION	PART NO.	QTY.	DESCRIPTION
S2	P001	1	28 PIN SOCKET
X1	XC13	1	CRYSTAL, 12.288 MHZ
R4	R025	1	RES, 220K .25W 5% CF
R12	R020	1	RES, 22K .25W 5% CF
R11	R017	1	RES, 2K .25W 5% CF
R2	R013	1	RES, 1.2 MEG .25W 5% CF
R6	R008	1	RES, 200 OHM .25W 5% CF
R1 7 9 13	R002	4	RES, 10K .25W 5% CF
R3 5	R000	2	RES, 100K .25W 5% CF
R14-16	R023	3	RES, 51K .25W 5% CF
Q1	Q003	1	VN10KM
Q2 3	Q001	2	MPS2907A PNP
J2	P016D	1	30 PIN VERTICAL 929974-3
J1	PA06	1	STIX, 5 PIN 1/2" 103321-5
J4	PA02	1	STIX, DUAL, 26 PIN 1-87543-3
U3	IM01	1	SRAM 8K x 8 BIT, 150 NS
U7	IC72	1	LT1039
U1	IC71	1	HD64180 8 BIT uP
U5 6	IC34	2	74HC00 QUAD DUAL POS NAND GATE
U4	IC05	1	74HC74 DUAL "D" FLIP FLOP
CR1-3	D000	3	SIGNAL 1N4148
C3 9 18-20	CT01	5	6.8uF 20% 16V TANTALUM
C4 5	CC01	2	22pF 10% 50V Z5U CERAMIC
C1, 2, 6-8, 10-17	CC12	13	.1uF 20% 50V Z5U CERAMIC
1	B081	1	PROTOCOL CONVERTER PCB 55N098-C

REV.	DESCRIPTION	BY	DATE
C	PER ECN NO. 3152M		2/9/92
B	PER ECN #3083M		12/91
A	PER ECN #2860		5/91

UNLESS SPECIFIED TOLERANCES ARE
X = ±.XX
XX = ±.XX
XXX = ±.XXX
ANGLES = 1/1 DEGREE
FRACTIONS
.XX = ±1/32 .XX = ±1/16

DRAWN		9/1/87
DESIGNED		9/87
CHECKED		9/1/87
APPROVED		9/87

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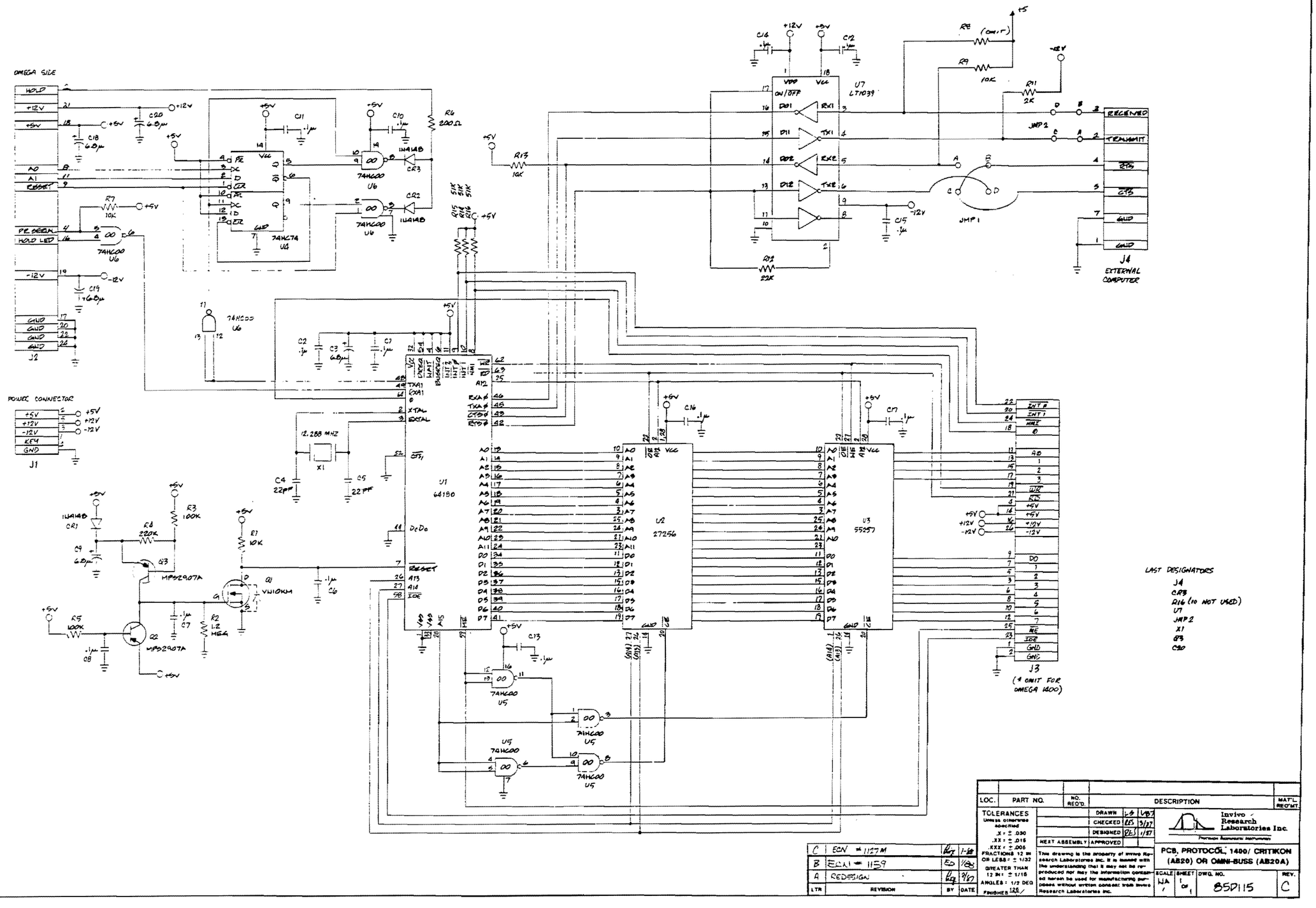
INVIVO RESEARCH INC.
3061 WEST ALBANY
BROKEN ARROW, OKLAHOMA 74012

TITLE
PCA, PROTOCOL CONVERTER,
1400/OMNI-BUSS #AB20A

SCALE	SHEET	DWG. NO.	REV.
2/1	1	94C393	C



LOC.	PART NO.	NO. REQ'D.	DESCRIPTION	MAT'L. REQ'MT.

TOLERANCES
Unless otherwise specified
.X = ± .030
.XX = ± .015
.XXX = ± .005
FRACTIONS 12 IN OR LESS = ± 1/32
GREATER THAN 12 IN = ± 1/16
ANGLES = 1/2 DEG
FINISHES 125

DRAWN	LS	1/87
CHECKED	RS	3/27
DESIGNED	RS	1/87
NEXT ASSEMBLY	APPROVED	

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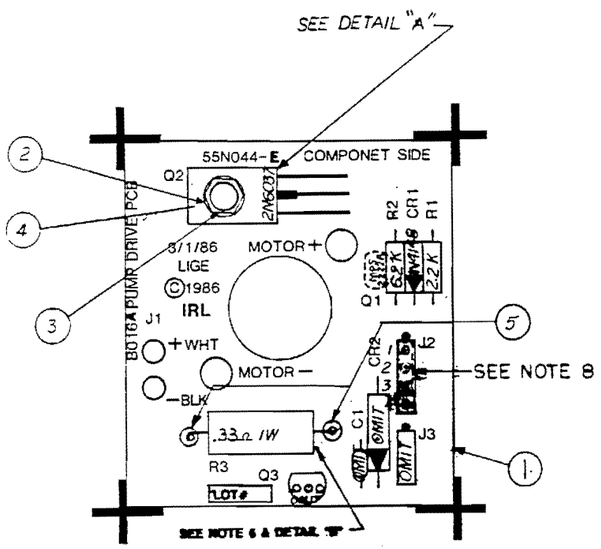
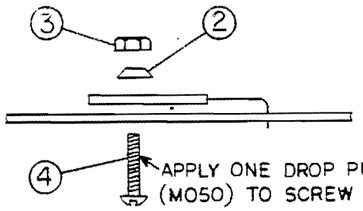
Invivo Research Laboratories Inc.
Precision Biomonitoring Instruments

PCB, PROTOCOL 1400/ CRITIKON (AB20) OR OMNI-BUSS (AB20A)

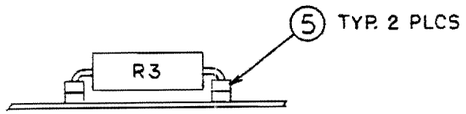
SCALE	SHEET	DWG. NO.	REV.
NA	1 OF 1	850115	C

LTR	REVISION	BY	DATE
C	ECN # 1127M	LS	1-88
B	ECN # 1159	RS	1/88
A	REDESIGN	LS	9/87





DETAIL "A"

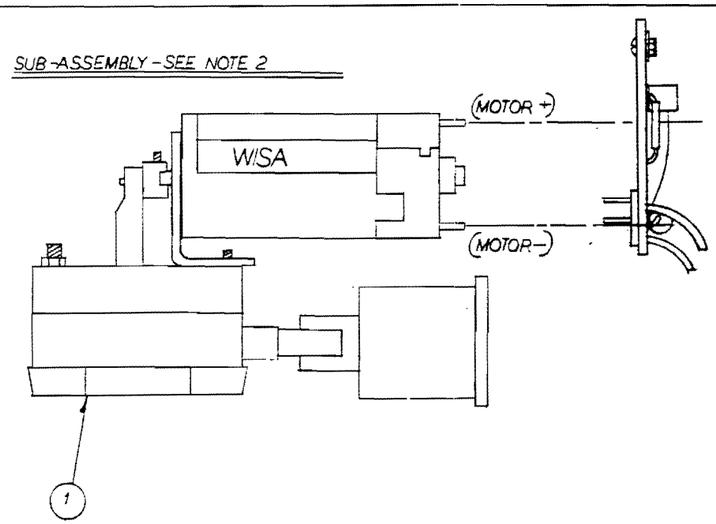


DETAIL "B"

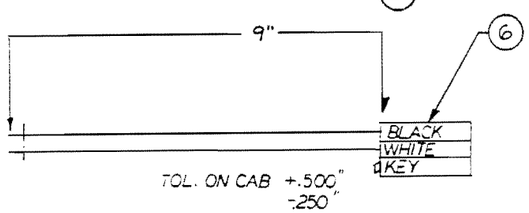
PCB ASSEMBLY-SEE NOTE 1

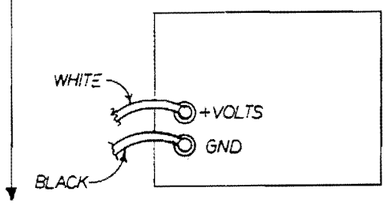
ITEM OR FIND	DESCRIPTION	QTY	PART #
1	PUMP DRIVE PCB 55N044E	1	B016A
2	COMPRESSION, #4 BS2200F006	1	NW10
3	NUT: #4-40 X 1/4" HEX, PLATED	1	N002
4	4-40 X 3/16" PH PNH PLD ZINC	1	NS26
R1	RES, 2.2K .25W 5% CF	1	R050
R2	RES, 6.2K .25W 5% CF	1	R028
CR1	SIGNAL 1N4148	1	D004
Q2	2N6037 NPN DARLINGTON	1	Q008
J2	STIX, 3 PIN, 1/2"	1	PA08
R3	RES., .33 OHM, 5%, 1W	1	R177
Q1	MPS2222A NPN	1	Q000
5	INSULATOR, BEAD, GLASS	4	HI-23
6	CABLE, PUMP/SUPPLY, OM 1400	1	AC77

SUB-ASSEMBLY - SEE NOTE 2



POWER/PUMP DRIVE CABLE (2)





NOTES:

1. ASSEMBLE PCB AS SHOWN. ROUTE TO INSPECTION. AFTER INSPECTION, ROUTE TO SUB-ASSEMBLY.
2. SUB-ASSEMBLY: SOLDER, AC77, CABLE TO PCB AS SHOWN, PLACE PCB ON PUMP, INSURING BOARD IS FLUSH WITH PUMP. SOLDER IN PLACE. BEND PUMP TERMINALS FLUSH TO BOARD, THEN ROUTE TO INSPECTION.
3. AFTER INSPECTION IS COMPLETE, ROUTE TO TESTING DEPARTMENT.
4. INSURE ALL PUMP HARDWARE IS TIGHT.
5. ONLY PURPLE LOC-TITE (M050) MAY BE USED IF PUMP REWORK IS NECESSARY.
6. RAISE R177, RESISTOR, 1/8" ±1/32 OFF OF BOARD.
7. MOUNT Q1 (MPS2222A) ON SOLDER SIDE AS SHOWN.
8. MOUNT J2 USING HOLES 1, 2, & 3 AS SHOWN. CLIP PIN 3 AT ASSEMBLY LEVEL AND VERIFY AT INSPECTION LEVEL.

LTR	REVISION	BY	DATE
T	PER ECN #2985		3/91
S	PER ECN #2822		5/91
R	PER ECN #2083		12/89
P	PER ECN #1977		3/89
N	PER ECN # 1662		1-12-89
M	PER ECN # 1559M		12/88
L	PER ECN # 1032		10/87
K	PER ECN # 996M		9/87
J	PER ECN # 957		5/87
H	PER ECN # 869		5/86
G	" " " # 726	GA	7/86
F	" " " # 695	GA	6/86
E	REVS PER ECN # 538		9/85
D	" " " " # 494	GA	7/85
C	REV REC ECN # 341		3/85
B	" " # 290	JN	3/84
A	SEE REV'S PER ECN # 239	BN	11/84

LOC.	PART NO.	NO. REQ'D.	DESCRIPTION	MAT'L. REQ'MT.
2	AC77	1	CAB POWER/PUMP, OM 1400	
1	HP23	1	PUMP, 6VDC 081.975.100.0	

TOLERANCES Unless otherwise specified: X = ± .030, XX = ± .010, XXX = ± .005, FRACTIONS 12 IN OR LESS = ± 1/32, GREATER THAN 12 IN = ± 1/16, ANGLES = 1/2 DEG, FINISHES 126

DRAWN LS 3/84 | CHECKED 4/84 | DESIGNED | NEXT ASSEMBLY | APPROVED 4/12

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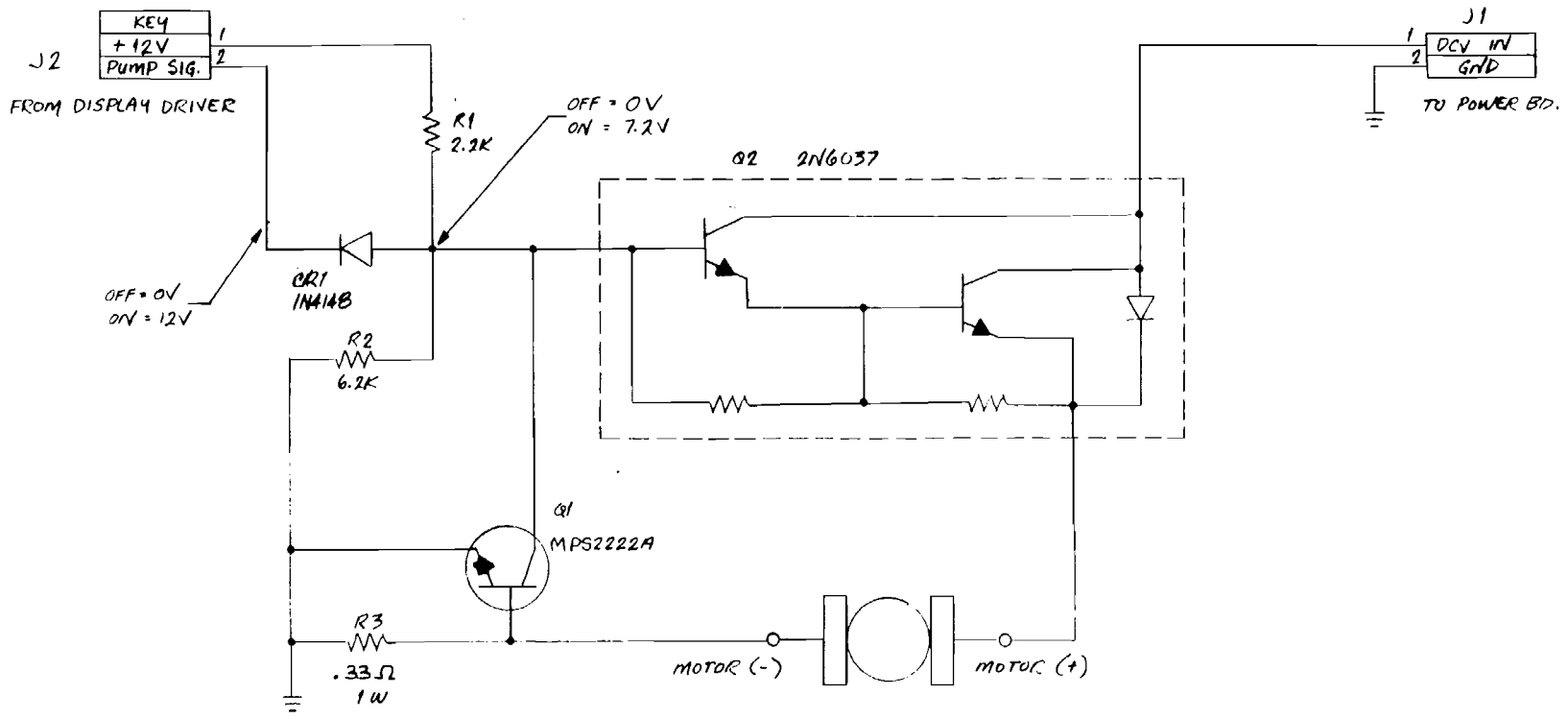
Invivo Research Laboratories Inc.
Precision Biomedical Instruments

ASSEMBLY BOARD: AP21
PUMP DRIVE, OMEGA 1400

SCALE NA | SHEET 1 OF 1 | DWG. NO. 94C217 | REV. T



LOC.	PART NO.	NO. REQ'D.	DESCRIPTION	MAT'L. REQ'MT.

E	PER ECN #2083		9/15/89
D	" " " #726	GA	1/86
C	" " " #584		11/85
B	CHANGE PER ECN #538		9/85
LTR	REVISION	BY	DATE

TOLERANCES
Unless otherwise specified
.X = ± .030
.XX = ± .016
.XXX = ± .005
FRACTIONS 12 IN OR LESS = ± 1/32
GREATER THAN 12 IN = ± 1/18
ANGLES = 1/2 DEG
FINISHES 125

DRAWN		3/15
CHECKED		4/15
DESIGNED		4/15
APPROVED		4/15
NEXT ASSEMBLY		

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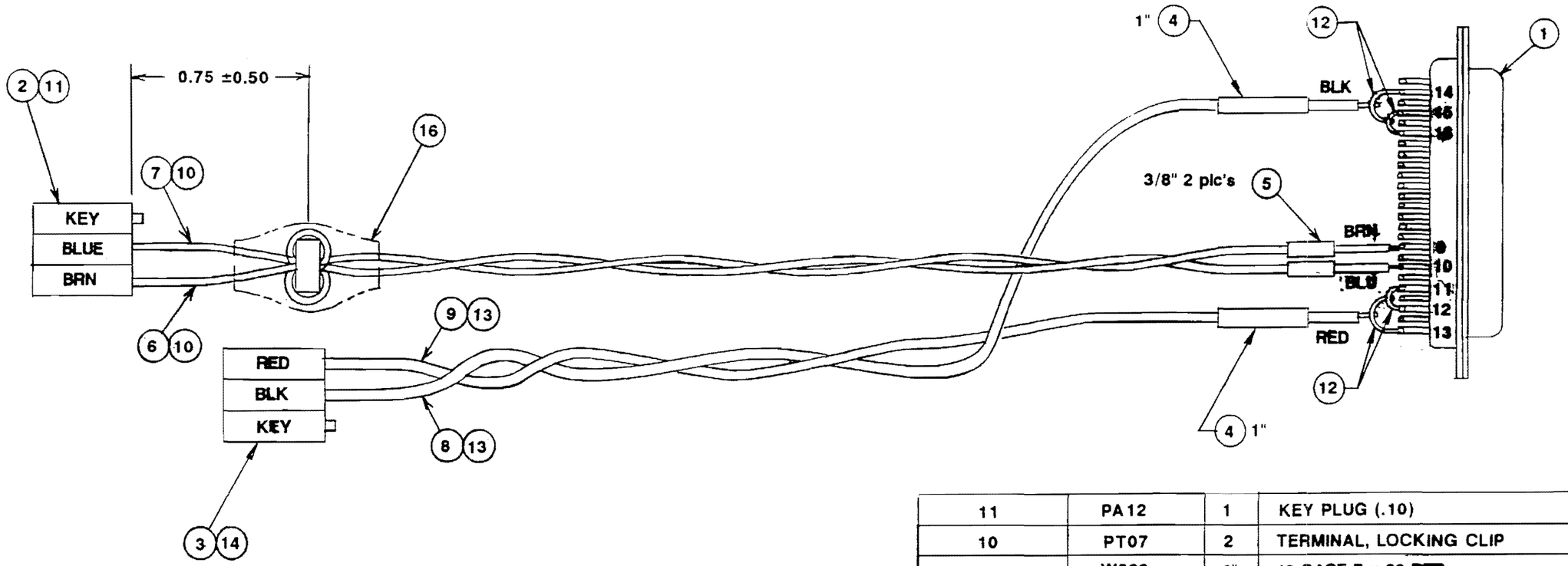
Invivo Research Laboratories Inc.
Precision Biomedical Instruments

SCHEMATIC: PUMP DRIVE, OMEGA 5000/1400 *AP21 /AP16

SCALE	SHEET	DWG. NO.	REV.
NA	1 OF 1	858070	E

12516 PRINTED ON NO. 1000H CLEARPRINT



16	WT10	1"	HEAT SHRINK, 3/8" ID, CLEAR
15	T023	1	SHIELDING BEAD
14	PA25	1	KEY PLUG (.156)
13	PT09	2	TERMINAL, RECEPTICLE, REEL
12	W019	2"	WIRE , BUSS, SOFT DRAWN, 24 GA.
LOCATION	PART NO.	QTY.	DESCRIPTION

11	PA12	1	KEY PLUG (.10)
10	PT07	2	TERMINAL, LOCKING CLIP
9	W022	9"	18 GAGE 7 x 30 RED
8	W017	9"	18 GAGE 7 x 30 BLK UL-1430
7	W010	12"	22 GAGE 7 x 30 BLUE UL-1429
6	W007	12"	22 GAGE 7 x 30 BRN UL-1429
5	WT04	3/4"	HEAT SHRINK 3/32" ID x 3/8 LG BLK
4	WT05	2"	HEAT SHRINK, 3/16" I.D. x 1" LG BLACK
3	PA26	1	HOUSING, SR, 3 PIN (.156)
2	PA20	1	HOUSING, SR 3 PIN (.10)
1	PA165	1	CONNECTOR, DB25, FEMALE, SOLDER TAIL
LOCATION	PART NO.	QTY.	DESCRIPTION

NOTES

1. BEFORE TWISTING THE BROWN AND BLUE WIRE TOGETHER, WRAP EACH WIRE TWO (2) TURNS AROUND AND THRU THE SHIELDING BEAD , ITEM 15 (P/N T023), THEN APPLY HEAT SHRINK, ITEM 16 (P/N WT10).

REV.	DESCRIPTION	BY	DATE
B	PER ECN #3083M		12/91
A	PER ECN # 3034		9/4/91

UNLESS SPECIFIED TOLERANCES ARE
X = ±.030
XX = ±.015
XXX = ±.005
ANGLES = 1/2 DEGREE
FRACTIONS
<12" = ±1/32 >12" = ±1/16

DRAWN		6/88
DESIGNED		12/91
CHECKED		7-25-88
APPROVED		

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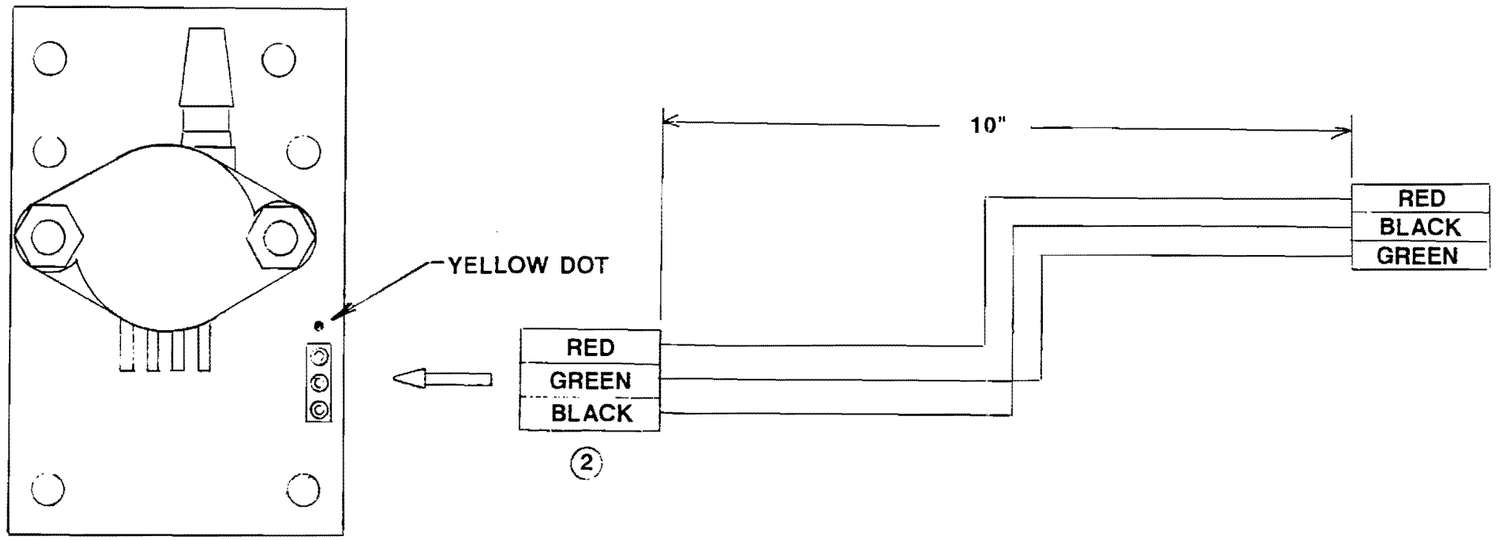
DOC. NO. 10A007

INVIVO RESEARCH INC.
3061 WEST ALBANY
BROKEN ARROW, OKLAHOMA 74012

TITLE
CABLE ASSEMBLY, INPUT/OUTPUT
MRI/1400 #AS93

SCALE	SHEET	DWG. NO.	REV.
NONE	1 OF 1	59B094	B



PLUG CABLE ASSEMBLY ON TRANSDUCER BOARD ASSEMBLY AS SHOWN.

A	PER ECN NO. 2913	CHH	7/23/91
REV.	DESCRIPTION	BY	DATE

2	AC82	1	TRANSDUCER CABLE, OM 1400/2120
1	AS80	1	XDCR MNTG BD ASSY, UNIVERSAL
LOCATION	PART NO.	QTY.	DESCRIPTION

UNLESS SPECIFIED TOLERANCES ARE
X = ±.030
XX = ±.015
XXX = ±.005
ANGLES = 1/2 DEGREE
FRACTIONS
<12" = ±1/32 >12" = ±1/16

DRAWN	Luis	11/87
DESIGNED	JNH	10/87
CHECKED	[illegible]	12/91
APPROVED	Luis	11/87

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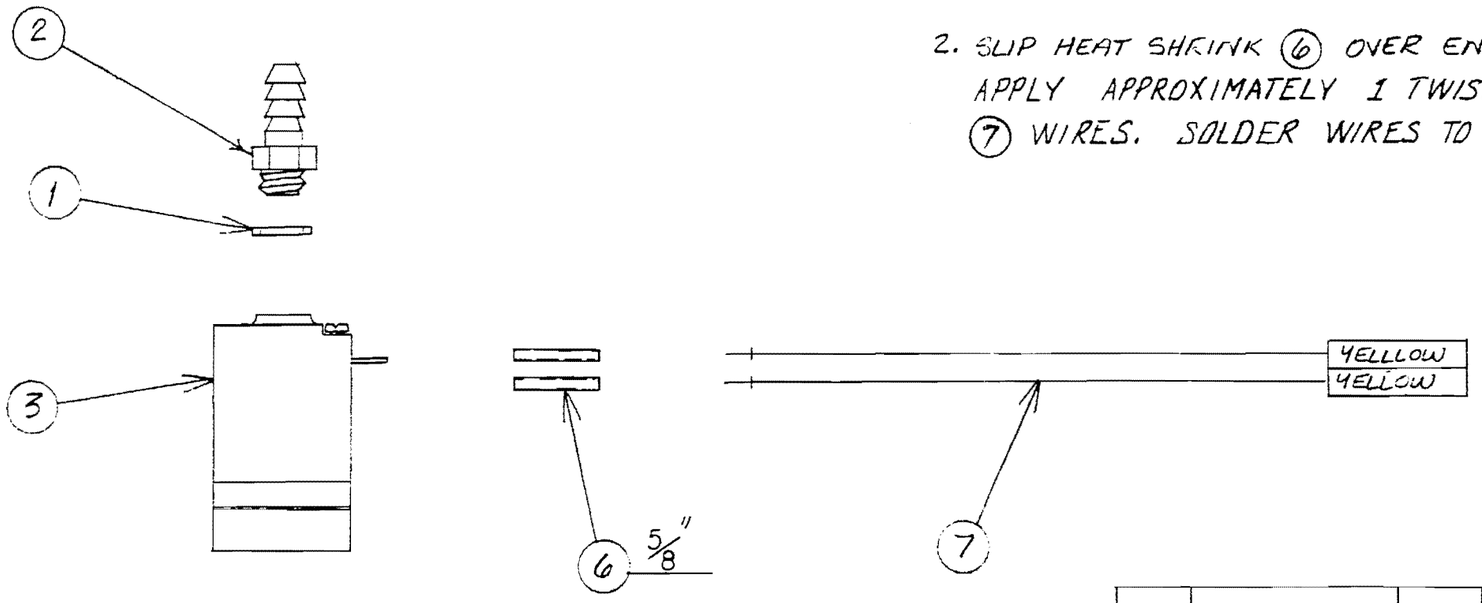
INVIVO RESEARCH INC.
3061 WEST ALBANY
BROKEN ARROW, OKLAHOMA 74012

TITLE
#AS37 - TRANSDUCER ASSEMBLY, OMEGA 1400/OHMEDA 2120

SCALE	SHEET	DWG. NO.	REV.
NA	1 / 1	94B384	A

1. SLIP BARB GASKET (1) ONTO THREADS OF BARB (2). APPLY RED LOCKTITE (MΦΦ7) ONTO THREADS OF BARB AND SCREW INTO TOP OF VALVE (3).

2. SLIP HEAT SHRINK (6) OVER ENDS OF WIRES OF VALVE CABLE (7). APPLY APPROXIMATELY 1 TWIST PER INCH TO VALVE CABLE (7) WIRES. SOLDER WIRES TO VALVE AND APPLY HEAT SHRINK.



7	AC73	1	CAB VALVE, HUMPHREY, OM 1400
6	WTΦA	1.25"	HEAT SHRINK 3/32" OD BLACK
5			
4			
3	HP3Φ	1	VALVE, 3E1 12 VDC
2	HPΦ6	1	FITTING, BARB 11752-3
1	HP14	1	GASKET, BARB 11761 BULK
LOC.	PART NO.	NO. REQ'D.	DESCRIPTION — MAT'L. REQ'MT.

LTR	REVISION	BY	DATE
F	PER ECN #3035	OHK	10/4/91
E	PER ECN #2379	SAP	5/90
D	PER ECN #1944	SAL	7/89
C	PER ECN # 1428	JKT	9/88
B	" " " " 423	BN	5/85
A	SEE REV'S PER ECN #319	BN	1/85

TOLERANCES
Unless otherwise specified
.X = ± .030
.XX = ± .015
.XXX = ± .005
FRACTIONS 12 IN OR LESS = ± 1/32
GREATER THAN 12 IN = ± 1/16
ANGLES = 1/2 DEG
FINISHES 125

	DRAWN	10/84
	CHECKED	10/84
	DESIGNED	5/90
NEXT ASSEMBLY	APPROVED	9/15

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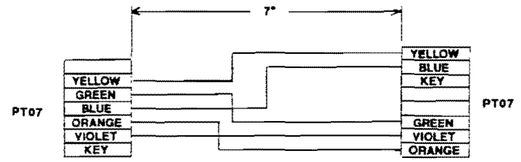
Precision Biomedical Instruments

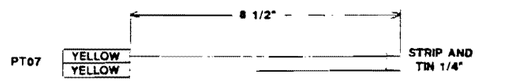
ASSEMBLY, SUB-ASSEMBLY: VALVE, HUMPHREY, OM 1400 #AP20

SCALE	SHEET	DWG. NO.	REV.
NA 1	1 OF 1	94B216	F

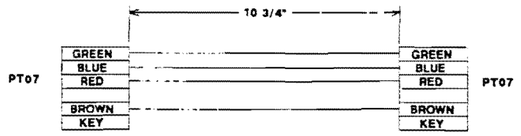
12X18 PRINTED ON NO. 1000H CLEARPRINT



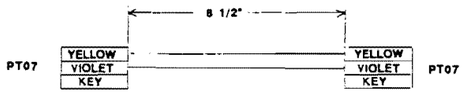
#AC72 ALARM CABLE (7 PIN HOUSING #PA09, 8 PIN HOUSING #PA14, KEY #PA12, TERMINALS #PT07, 22 GAGE WIRE)



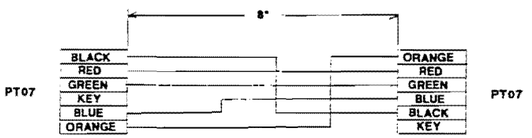
#AC73 VALVE CABLE (HOUSING #PA21, TERMINALS #PT07, 22 GAGE WIRE)



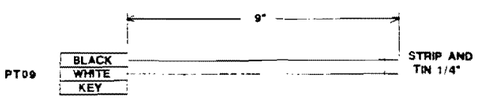
#AC74 DISPLAY CABLE (HOUSINGS #PA10, KEY #PA12, TERMINALS #PT07, 22 GAGE WIRE)



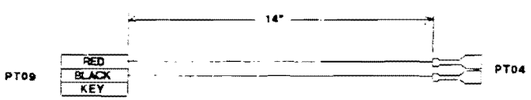
#AC75 PUMP CABLE (HOUSING #PA20, KEY #PA12, TERMINALS #PT07, 22 GAGE WIRE)



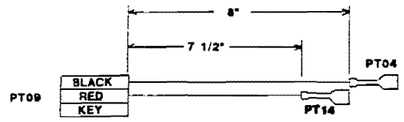
#AC76 PRINTER CABLE (HOUSINGS #PA10, KEY #PA12, TERMINALS #PT07, 22 GAGE WIRE)



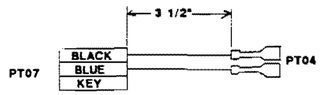
#AC77 PUMP SUPPLY CABLE (HOUSING #PA26, KEY #PA25, TERMINALS #PT09, 18 GAGE WIRE)



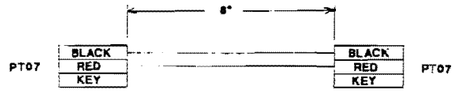
#AC78 BATTERY CABLE (HOUSING #PA26, KEY #PA25, TERMINALS #PT04, TERMINALS #PT09, 18 GAGE WIRE)



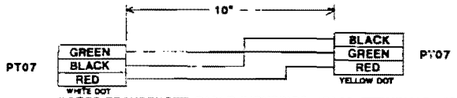
#AC79 FRONTPANEL POWER SWITCH CABLE (HOUSING #PA26, KEY #PA25 , TERMINALS #PT09, TERMINAL #PT04, TERMINAL #PT14, 18 GAGE WIRE)



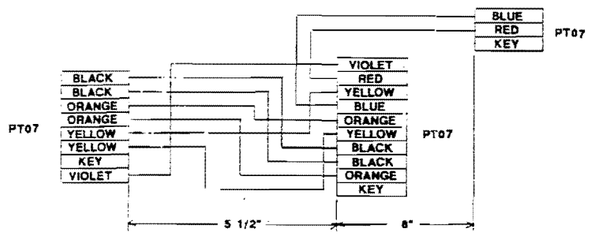
#AC80 ADULT/NEO CABLE (HOUSING #PA20, KEY #PA12, TERMINALS #PT04, TERMINALS #PT07, 22 GAGE WIRE)



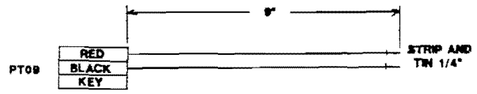
#AC81 PAPER FEED CABLE (HOUSINGS #PA20, KEY #PA12, TERMINALS #PT07, 22 GAGE WIRE)



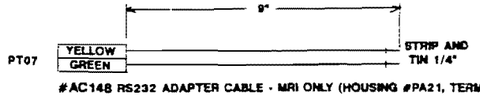
#AC82 TRANSDUCER CABLE (HOUSINGS #PA20, TERMINALS #PT07, 22 GAGE WIRE)



#AC83 POWER CABLE (3 PIN HOUSING #PA20, 8 PIN HOUSING #PA14, 10 PIN HOUSING #PA27, KEYS #PA12, TERMINALS #PT07, 22 GAGE WIRE)



#AC147 POWER CABLE - MRI ONLY (HOUSING #PA26, KEY #PA12, TERMINALS #PT09, 18 GAGE WIRE)



#AC148 RS232 ADAPTER CABLE - MRI ONLY (HOUSING #PA21, TERMINALS #PT07, 22 GAGE WIRE)

TOLERANCE ON ALL CABLES = ±1/2".

NOTES: 1. REFER TO DWG. #978218 FOR CRIMPING INSTRUCTIONS.

WIRE CHART

22 GAGE WIRE	18 GAGE WIRE
BLACK___#W005	BROWN___#W015
ORANGE___#W006	BLUE___#W016
BROWN___#W007	BLACK___#W017
VIOLET___#W008	WHITE___#W018
RED___#W009	RED___#W022
BLUE___#W010	
GREEN___#W011	
YELLOW___#W012	
WHITE___#W032	

REV.	DESCRIPTION	BY	DATE
AA	PER ECN #2686		6/91
Y	PER ECN #2066		1/91
X	PER ECN #1278		7/89
W	PER ECN #1173		2/89
V	PER ECN #1153		
T	PER ECN #1071		11/87
S	PER ECN #966		9/87
R	PER ECN #869		5/87
A - P	SEE OBSOLETE FILE		

LOCATION	PART NO.	QTY.	DESCRIPTION
UNLESS SPECIFIED TOLERANCES ARE: X = ±.005, XX = ±.025, XXX = ±.010, ANGLES = ±1/2 DEGREE, FRACTIONS ±1/64, .XX = ±.02, .XXX = ±.010			

DRAWN		9/87
DESIGNED		9/87
CHECKED		
APPROVED		

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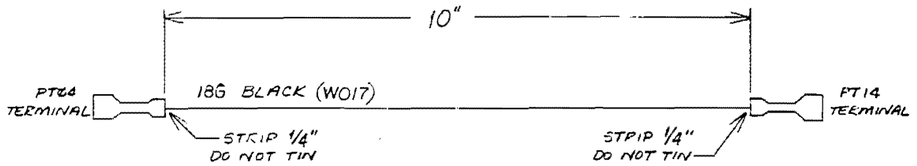
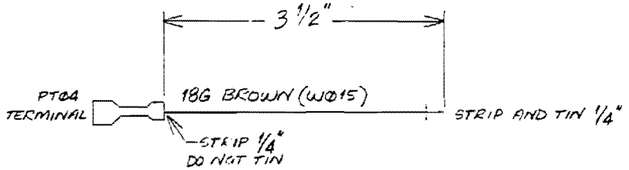
INVIVO RESEARCH INC.
3061 WEST ALBANY
BROKEN ARROW, OKLAHOMA 74012

TITLE: CABLE ASSEMBLIES, OMEGA 1400

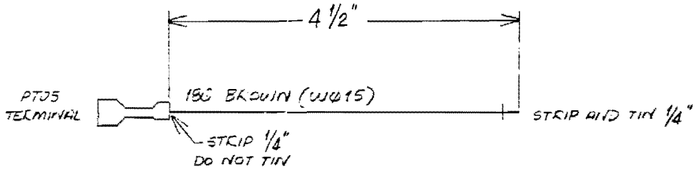
SCALE	SHEET	DWG. NO.	REV.
N.A.	1 / 1	59D051	AA



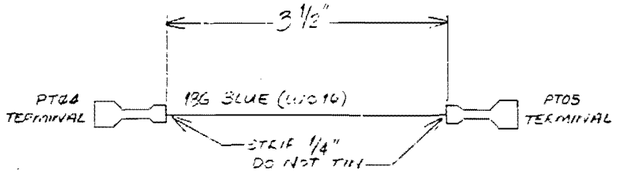
AW87 FRONTPANEL POWER SWITCH (1A) TO OVER PRESSURE SWITCH (BOTTOM)



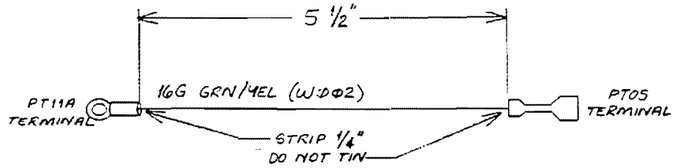
AW88 REARPANEL POWER SWITCH (1a) TO FUSE (HOT)



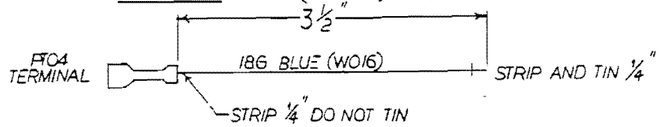
AW89 CORCOM (LINE) TO FUSE



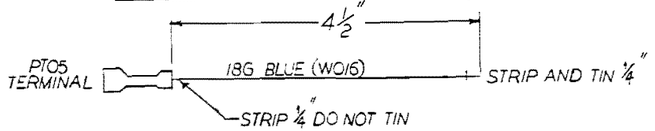
AW90 REARPANEL POWER SWITCH (2a) TO CORCOM (NEUTRAL) 110V



AW91 CORCOM (GROUND) TO CHASSIS GROUND



AW94 REARPANEL POWER SWITCH (1a) TO FUSE (HOT) 220V



AW95 CORCOM (NEUTRAL) TO FUSE 220V

NOTES

1. ON ALL WIRES, TOLERANCE +.500" -.250"
2. ALL WIRES USED ON BOTH 110V AND 220V EXCEPT AW94 – AW95 (220V ONLY), AW90 (110V ONLY).

LTR	REVISION	BY	DATE
F	PER ECN # 933	ED	7/87
E	PER ECN # 864	ED	5/87
D	REV'S PER ECN #306	BN	1/85
C	" " " #294	JN	12/84
B	" " #266	BN	12/84
A	SEE REV'S PER ECN #237	BN	11/84

LOC.	PART NO.	NO. REQ'D.	DESCRIPTION	MAT'L REQ'MT.

TOLERANCES Unless otherwise specified .X = ± .030 .XX = ± .015 .XXX = ± .005 FRACTIONS 12 IN OR LESS = ± 1/32 GREATER THAN 12 IN = ± 1/16 ANGLES = 1/2 DEG FINISHES 125

DRAWN	[illegible]	11/84	
CHECKED	JN	11/84	
DESIGNED			
NEXT ASSEMBLY	APPROVED	LES	11/84

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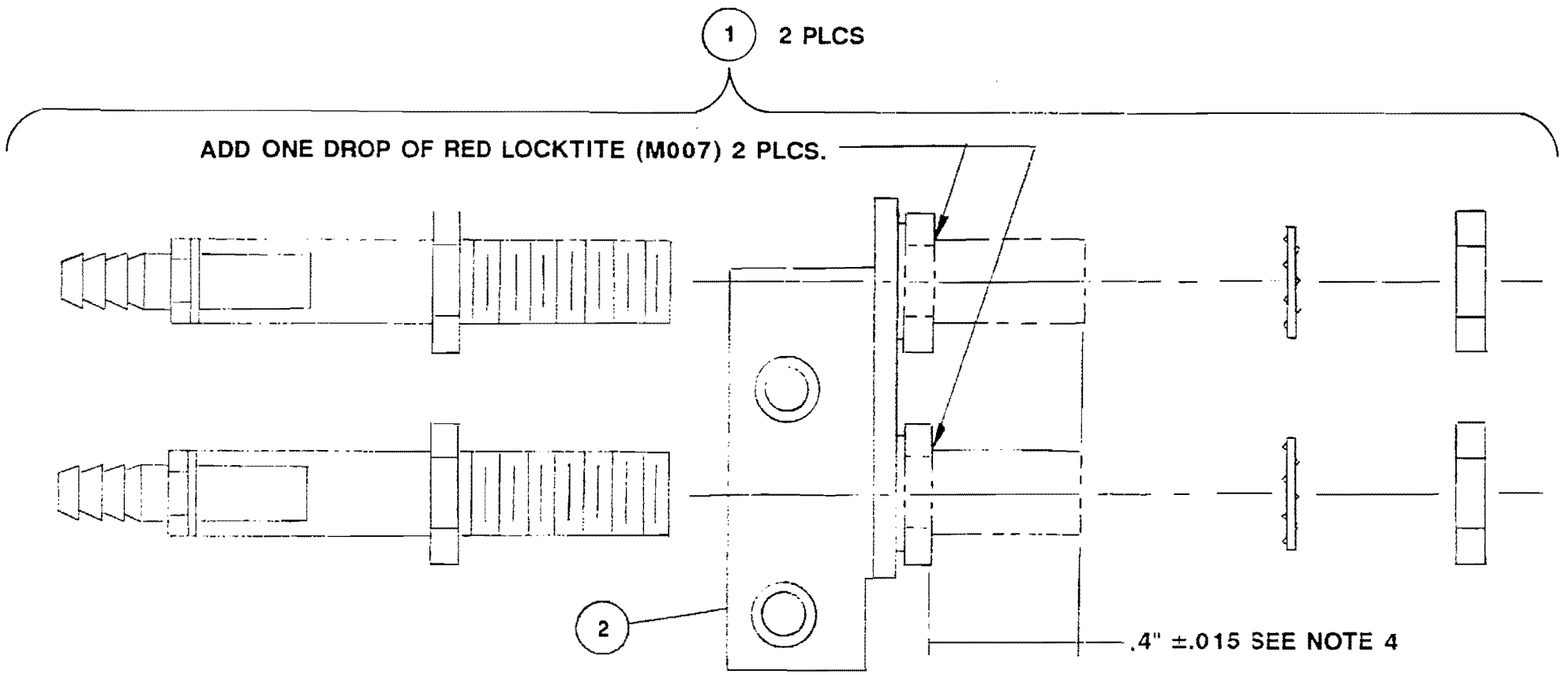
Invivo Research Laboratories Inc.
Precision Biomedical Instruments

ASSEMBLY, WIRE: OMEGA 1400 WIRES

SCALE	SHEET	DWG. NO.	REV.
N/A	1 OF 1	570009	F

10X14 PRINTED ON RD. 1000R CLEARPRINT



ASSEMBLY NOTES

1. REMOVE AND SALVAGE ONE OF THE TWO LOCKWASHERS PROVIDED IN THE ADAPTER ASSEMBLY.
2. THREAD ON ONE NUT AND TIGHTEN AGAINST VALVE BODY.
3. INSERT VALVE INTO ANGLE BRACKET, SLIP ON LOCKWASHER AND THREAD ON REMAINING NUT (TIGHTEN AS REQ'D).
4. ENSURE ADAPTERS ARE ALIGNED.

REV.	DESCRIPTION	BY	DATE
E	PER ECN #2415	[illegible]	[illegible]
D	PER ECN #2283	[illegible]	3/90
C	PER ECN #1012	ED	9/87
B	PER ECN #954M	ED	8/87
A	PER ECN #354	BN	2/85

LOCATION	PART NO.	QTY.	DESCRIPTION
2	HM06G	1	CHS, OM 5000/1400, ANGLE BRACKET
1	AP07A	2	ASSY, HOSE ADAPTER W/O VALVE

UNLESS SPECIFIED TOLERANCES ARE
X = ±.030
XX = ±.015
XXX = ±.005
ANGLES = 1/2 DEGREE
FRACTIONS
<12" = ±1/32 >12" = ±1/16

DRAWN	[illegible]	3/90
DESIGNED	[illegible]	3/90
CHECKED	[illegible]	3/90
APPROVED	[illegible]	3/90

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INVIVO RESEARCH INC.
12443 RESEARCH PARKWAY #201
ORLANDO, FLORIDA 32826

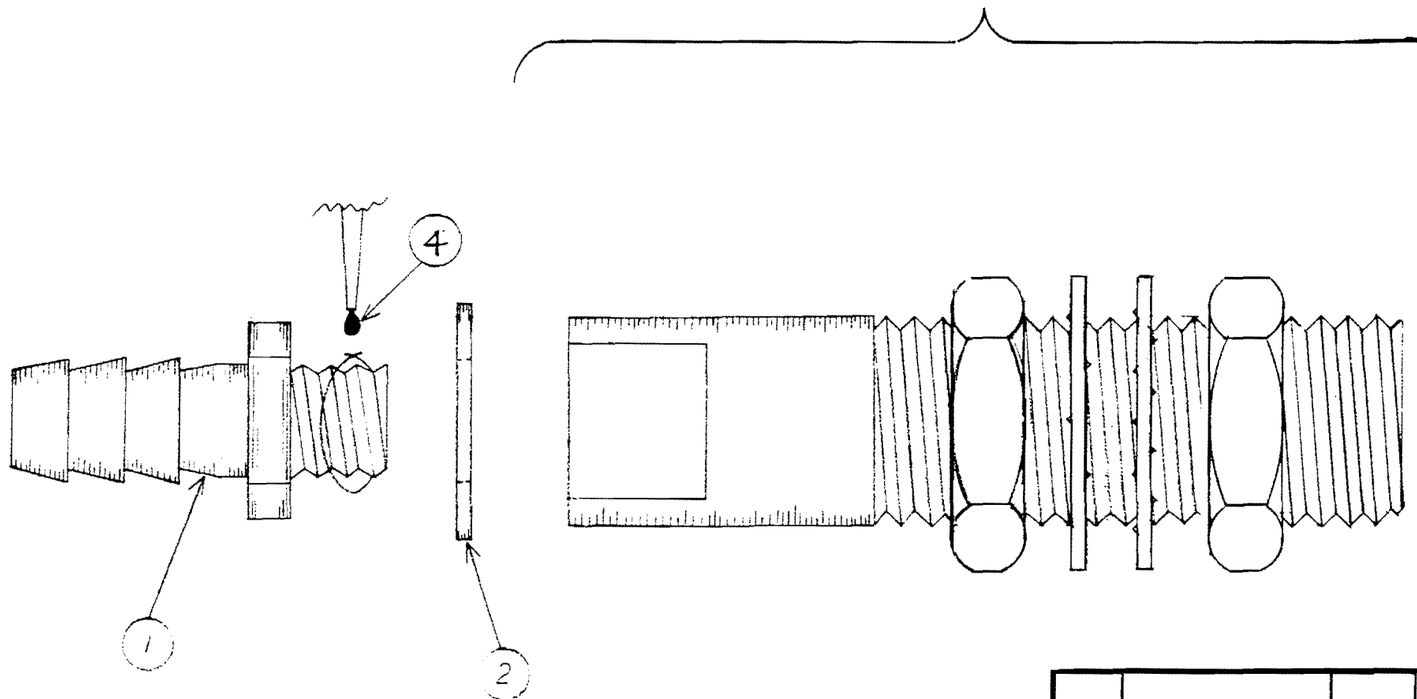
TITLE
ASSEMBLY: AP15 PATIENT PORT, PNEUMATIC, OMEGA 5000/1400

SCALE	SHEET	DWG. NO.	REV.
N/A	1 OF 1	94B106	E

94B073

1. INSTALL RUBBER WASHER (2)(HP14) ONTO THREADS OF BARB (1)(HP06). APPLY ONE DROP OF RED LOCKTITE (4)(M007) TO BARB THREADS. INSURE LOCKTITE DOES NOT ENTER OR COME NEAR BARB APERATURE BUT COMPLETELY ENCIRCLES A MINIMUM OF ONE THREAD. INSERT BARB INTO VALVE BODY (3)(HP07A) AND TIGHTEN SECURELY WITH 1/4" NUTDRIVER.
2. THREAD NUTS AND LOCKWASHERS ONTO CONNECTOR BODY AS SHOWN AND FINGER TIGHTEN. LOCATION IS NOT CRITICAL.

3. ENSURE VALVE STEM IS TIGHTENED INSIDE VALVE BODY.



LOC.	PART NO.	NO. REQ'D.	DESCRIPTION	MAT'L. REQ'MT.

LTR	REVISION	BY	DATE
D	PER ECN # 2035	CHA	10/91
C	PER ECN #	[illegible]	8/91
B	PER ECN # 1748M	DRM	2/24/89
A	ADD NOTE 3	LS	5/83

TOLERANCES
Unless otherwise specified
.X = ± .030
.XX = ± .015
.XXX = ± .005
FRACTIONS 12 IN OR LESS = ± 1/32
GREATER THAN 12 IN = ± 1/16
ANGLES = 1/2 DEG
FINISHES 125

DRAWN	LS	4/83
CHECKED	[illegible]	9/91
DESIGNED	[illegible]	9/91
NEXT ASSEMBLY	APPROVED	[illegible]

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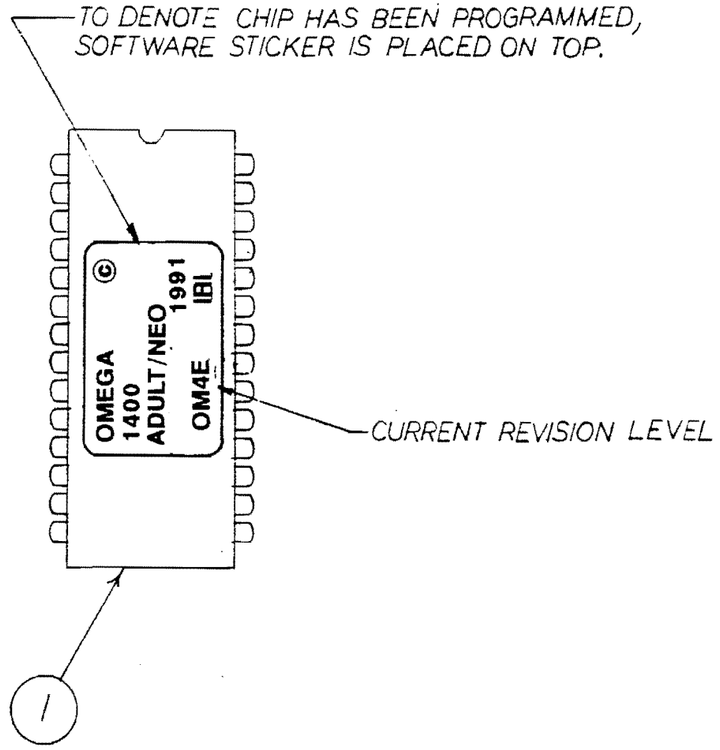
Invivo Research Laboratories Inc.
Precision Biomedical Instruments

#AP07- ASSEMBLY, PNUMATIC: HOSE ADAPTEE, MOD-3

SCALE	SHEET	DWG. NO.	REV.
NA	1 OF 1	94B073	D

DIETZGEN MASTER FORM 198MF



NOTES:

1. PLUG BLANK CHIP INTO PROGRAMMER.
2. VERIFY EPROM IS BLANK.
3. INSTALL MASTER EPROM. (CHECK SUM @ 24EO = 04A)
4. START PROGRAMMING.
5. VERIFY PROGRAMMING IS COMPLETE.
6. REMOVE CHIP FROM PROGRAMMER.
7. **PLACE SOFTWARE STICKER ON TOP OF CHIP AND WRITE CURRENT REVISION LEVEL ON LABEL.**

LTR	REVISION	BY	DATE
M	PER ECN NO. 2853	CHH	5/29/91
L	PER ECN NO. 2803M	CHH	9/9/91
K	PER ECN #2603	CHH	10/16/90
J	PER ECN #2151	CHH	12/28/89
H	PER ECN# 1493	RF	11/88
G	" " #1161M	ED	1/88
F	" " #617	GA	1/86
E	PER ECN #591	Eng	11/85
D	" " " #509	GA	7/85
C	" " " #431	Eng	5/85
B	REVS PER ECN #368	Eng	3/85
A	REV'S PER ECN #297	BN	1/85

LOC.	PART NO.	NO. REQ'D.	DESCRIPTION	MAT'L. REQ'MT.
2	L045	1	LABEL, SFWR, 1400, 1991	
1	IM25	1	EPROM, 16K x 8 BIT, 200NS	

TOLERANCES
Unless otherwise specified
.X = ± .030
.XX = ± .015
.XXX = ± .005
FRACTIONS 12 IN OR LESS = ± 1/32
GREATER THAN 12 IN = ± 1/16
ANGLES = 1/2 DEG
FINISHES 125

	DRAWN	BN	1/84
	CHECKED		
	DESIGNED		
NEXT ASSEMBLY	APPROVED	TWF	1/91

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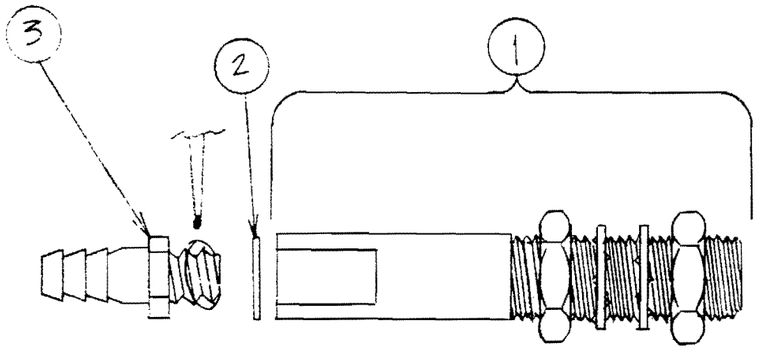
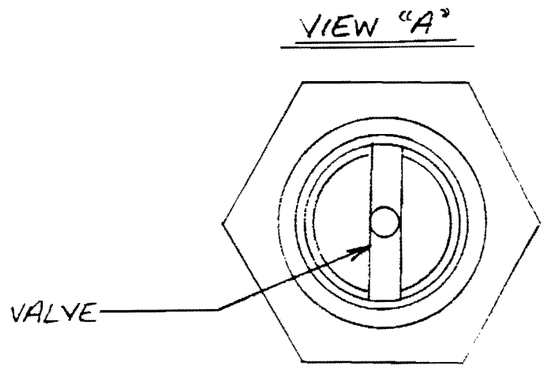
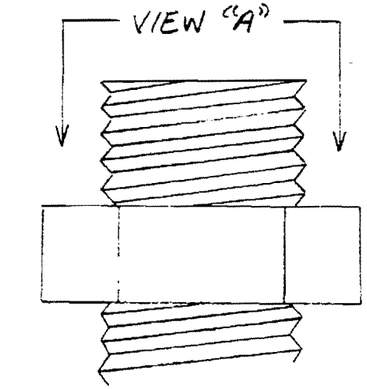
PROM SET, OMEGA 1400
#AM07

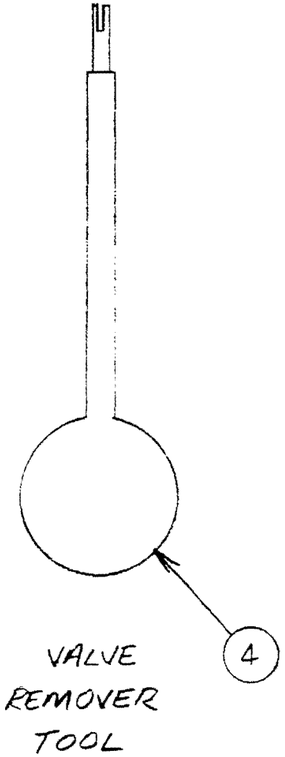
SCALE	SHEET	DWG. NO.	REV.
2/1	1 OF 1	94B237	M

12X18 PRINTED ON NO. 1000H CLEARPRINT









1. INSTALL RUBBER WASHER (2) ONTO THREADS OF BARB FITTING (3). APPLY ONE DROP OF RED LOCKTITE (M007) TO THREADS. INSURE LOCKTITE DOES NOT ENTER OR COME NEAR BARE APERATURE BUT COMPLETELY ENCIRCLES A MINIMUM OF ONE THREAD. INSERT BARB INTO VALVE BODY (1) AND TIGHTEN SECURELY WITH 1/4" NUT-DRIVER.
2. THREAD NUTS AND LOCKWASHER ONTO CONNECTOR BODY AS SHOWN AND FINGER TIGHTEN. LOCATION IS NOT CRITICAL. SAFETY.
3. REMOVE VALVE STEM FROM CONNECTOR BODY WITH TOOL (4).

LOC.	PART NO.	NO. REQ'D.	DESCRIPTION	MAT'L. REQ'MT.
3	HP06	1	FITTING, BARB 11752-3	
2	HP14	1	GASKET, BARB 11761 BULK	
1	HP07A	1	VALVE BODY	

LTR	REVISION	BY	DATE
C	PER ECN #3035	DHH	12/4/91
B	PER ECN # 1497	~~ST~~ LS	11/88
A	REVS PER ECN # 176	LS	7/84

TOLERANCES
Unless otherwise specified
.X = ± .030
.XX = ± .015
.XXX = ± .005
FRACTIONS 12 IN OR LESS = ± 1/32
GREATER THAN 12 IN = ± 1/16
ANGLES = 1/2 DEG
FINISHES 125

DRAWN	LS	4/84
CHECKED	[illegible]	8/85
DESIGNED	[illegible]	10/91
NEXT ASSEMBLY	APPROVED	[illegible]

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ASSY, PNEUMATIC, HOSE ADAPTER, WITHOUT VALVE #AP07A

SCALE	SHEET	DWG. NO.	REV.
N/A	1 OF 1	94B135	C

12X18 PRINTED ON NO. 1000H CLEARPRINT

Subject to alteration without prior notice.

Servo Ventilator 900 C – Operating Manual Order No: 69 78 761 E313

SIEMENS-ELEMA AB
Ventilator Division
S-171 95 SOLNA
Sweden

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